February 23, 1924

McGraw-Hill Company, Inc.

Twenty-five Cents Per Copy

LIBRARY
FEB 25 1924

ENGINEERING & MINING
JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS

William Kelly

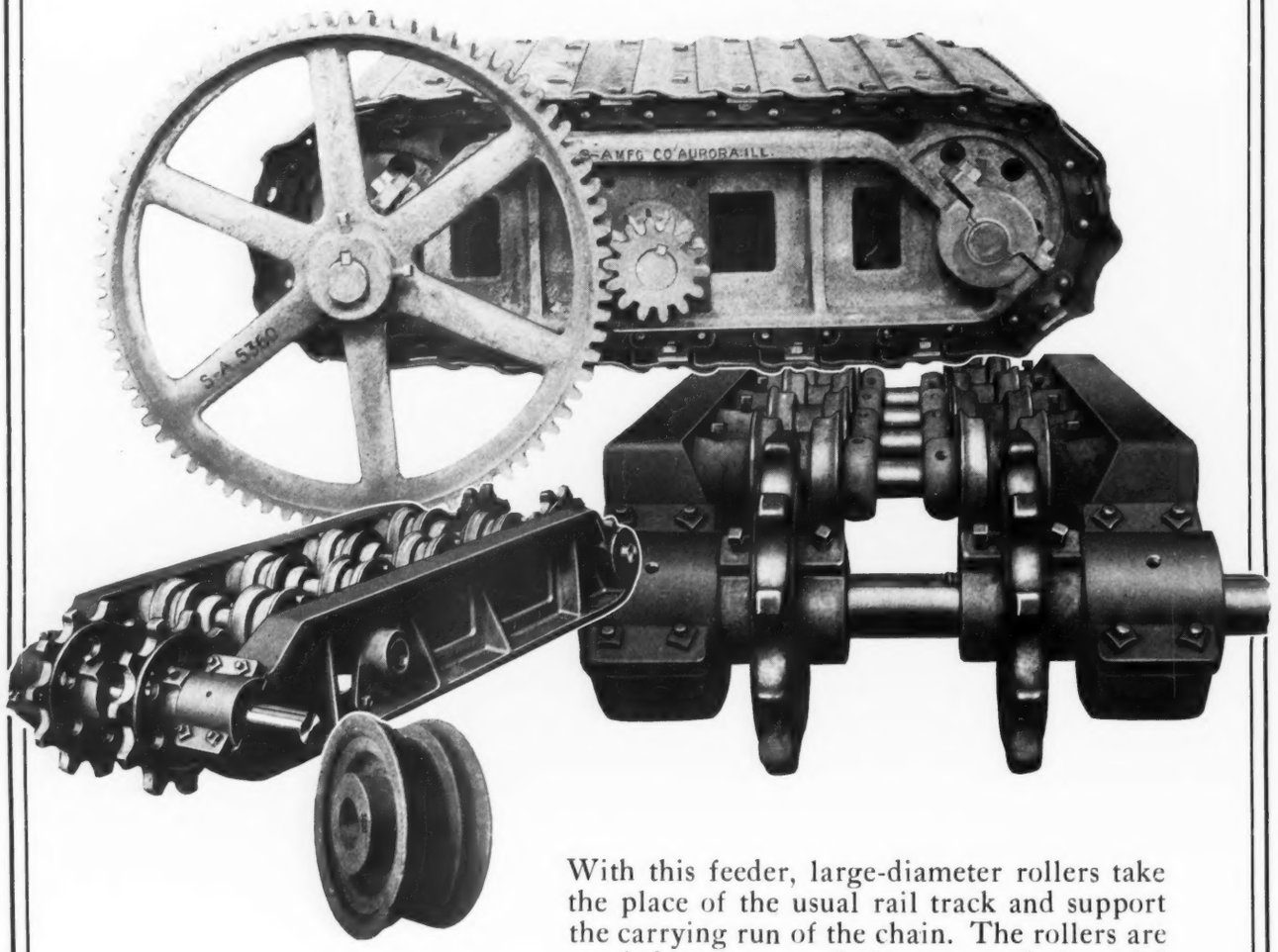
Newly Elected President of the American Institute of Mining and Metallurgical Engineers

Synchronous Motors, Their Widening Use in Mining and Milling, by Girard B. Rosenblatt—Peripheral-Discharge Cylindrical Mills, by A. W. Allen—A Growing Field for the Mining Engineer, Advantages Offered by the Non-Metallic Mineral Industries, by Arthur B. Parsons

New York Meeting of the A.I.M.E.

S-A Steel Apron Feeders

Roller Track Type



We carry in stock self-contained feeders of the type illustrated. Other sizes and types can be furnished promptly.

With this feeder, large-diameter rollers take the place of the usual rail track and support the carrying run of the chain. The rollers are carried on cross shafts mounted in solid bearings which rest on the steel framework. Spaced at close intervals the rollers are placed and so designed that the load is carried thru the side links of the Chain. This arrangement relieves the otherwise severe wear on the small chain rollers. With this design the rollers are engaged only when passing around the sprockets. This feeder is built in widths up to 60 inches and in any lengths to suit requirements.

STEPHENS-ADAMSON

AURORA **MFG. CO.** ILLINOIS

ENGINEERING & MINING
JOURNAL-PRESS
JOSIAH EDWARD SPURR, Editor

Volume 117 New York, February 23, 1924 *Number* 8

Leakage at Teapot Dome

TECHNICAL and economic aspects of the Teapot Dome brew, which will apparently be a national issue for some time to come, must be kept separately in mind from the ethical and political aspects. The Teapot dome is a structural dome in Wyoming, whose underlying strata contain petroleum. It is a government reserve, kept for the future use of the Navy, and given over to its care for that purpose. Structural domes act to impound petroleum, since this tends to rise on account of its gaseous content and consequent gaseous pressure, and so creates a reservoir for itself under uparching beds sufficiently impervious to retain it. On the flanks of this dome the oil-bearing strata belonged to oil companies, especially the Standard Oil. The technical basis claimed by the cabinet officials for the advisability of tapping the dome for oil at once was that otherwise the wells drilled by the oil companies on its flanks would draw off the oil from the government reserve. What about the truth of this claim? The experts of the Bureau of Mines have testified in Congress that the claim is well-founded; the experts of the Geological Survey testified that it had no basis. This is one of the most lamentable features to mining engineers, of this whole mess. Why is it that both these bureaus, in the same executive department, could not have reached an agreement on this highly important matter before taking any hand in it? Their difference discredits petroleum engineers and the government bureaus; and raises the question whether the explanation lies entirely in technology, or partly in politics.

A Government Snap

THE U. S. Civil Service Commission sends the editor the "announcement of an open competitive examination" in which he optimistically believes that we "may be interested." In any case "The Commission would appreciate your assistance in bringing this announcement to the attention of qualified persons." Which we hereby do. The examinations are for two "positions"—that of "laboratorian (mechanical)" and "laboratorian (metallurgical)."

"Vacancies at the Naval Experiment Station, Annapolis, Md., at $4.56 per diem for laboratorian (mechanical), and $4.32 per diem for laboratorian (metallurgical), and vacancies in positions requiring similar qualifications, at these or higher or lower salaries, will be filled from these examinations, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion."

For the position of laboratorian (mechanical) you have to compete in a written examination of six and a half hours, on mathematics (through trigonometry), elementary physics, and mechanical engineering (elementary). For the position of laboratorian (metallurgical) you must pass the examination on general chemistry and physics, and physical metallurgy. And your education, training, and experience is also taken into account and carefully weighed. Applicants for the first-named position must have completed a full four-years' high-school course, and two years of work in a college or university of recognized standing. Those hungering for the last-named job must have the same record, or they may substitute a one-year's practical experience for the two years in college. (College authorities please take note of the equivalency of one year's practical experience for two years in college). You must also send your photograph and expect a physical examination. Two and one-half per cent will be deducted from your salary against an annuity when you retire. Applicants must not be less than eighteen nor more than forty-five years of age. It takes health, youth, intellectual vigor, pep, education, and everything to secure these jobs. One other thing, though: you must be an American citizen.

Doubtless this sounds discouraging: but why not take a chance? If you win, you earn, if you have some metallurgical training, four dollars and thirty-two cents every day you work. If you are able to handle the laboratorian (mechanical) "position," you earn twenty-four cents more a day.

Benefits of Moral Support and Capital in Metallurgical Research

THE ECONOMIES that have resulted from the introduction of the new copper-silicon anodes at Chuquicamata are such that it may be said that the first phase in the development of that gigantic enterprise has been passed—the perfection of cheap and efficient technical methods for the extraction and recovery of the copper. The history of the Chile Copper Co. provides many lessons of deep significance to the capitalist, as well as to the non-technical observer. It shows that the essentials needed for successful achievement comprise unhampered research, adequate capital, and moral support, the influence on Chile's copper industry of all of which has been marked since the consummation of the original idea of large-scale operations in 1915.

It is interesting to note that improvements in technology and economies of operation have been steady but by no means rapid. In 1915 the plant operated for seven and one-half months, and 625,394 tons of ore was treated, with an extraction of only 66.87 per cent. In 1916, 1,742,748 tons was treated, with an extraction of only 77.15 per cent; and it was not until about 18,000,000 tons had been treated and an experience extending over five years or so had been gained that an extraction of 90 per cent was achieved.

One wonders what would have happened to the Chuquicamata process if it had not been backed by the

availability and influence of ample capital; if those who were responsible for the inception of the plan had been systematically balked in their demands for adequate research; and if enthusiasm had been dampened at the outset and capital diverted in other directions by a verdict based entirely on the opinions of those who were sceptical of ultimate success, or envious of initiative, or both—a verdict that took account of nothing more than the poor metallurgical showing and the comparatively high cost of production at the outset of operations.

Capital and wealth, and the influence and power that accompanies them, are the most important factors in the development of a technical process; but even with such advantages, progress may be slow. It behooves the casual investigator to realize that, in condemning or discouraging research in a development the initial results of which have not been spectacular, and of the inner history of which he probably knows nothing, he is incurring a grave responsibility. A fair and honest appraisal is often difficult, but he can feel safe in giving due credit to those whose contributions to technical advance and industrial progress have been given publicity without reserve and who have thus shown enough confidence in their work to welcome scientific criticism. This is the gospel of modern technical journalism, without which science would be at a standstill.

Editorial Policy

A SUBSCRIBER writes to us that if we editorially condemn certain crooked or plainly disastrous mining promotions, we should, in all fairness, and in our rôle as "spokesman for the industry," set our seal of approval on meritorious promotions and recommend them for investment. Theoretically, this appears beyond question: indeed, many of our readers, we know, would favor our overlooking the fraudulent promotions (on the ground that emphasizing them only served to discredit the entire mining industries), and speaking only with praise, if we speak at all. But as we visualize this policy, we foresee rocks ahead. Suppose we editorially recommend to the investor Idaho Copper, or Hercules Gold, or the Regina Consolidated, in the same spirit in which we disapprove of Circle Copper, or Saskatchewan Gold, or the Barons Consolidated. We have vision enough to see the indignant letters that would come in. "Your shameless support of Idaho Copper proves you are simply the tool of the Interests." "Why should a journal of the mining industries support a specific mining enterprise: and just what is your personal connection with that enterprise?" Suppose, even, that we were so fully convinced in the merit of a certain mining stock or promotion that we not only recommended its purchase to our readers, but bought shares in it ourselves? Suppose that the story came out, through ourselves—or, far better, through some sleuth? How would it look to our readers—to the industry? Bad—very bad. Thus is the theoretically indicated editorial policy blocked by the consideration of human nature. We have done something—almost as much, possibly, as we can—by publishing our Facts for the Stockholder series, from which any investor can judge whether he would like to buy, quite as well as we can. Some of these are good investments, others are probably not good investments, but they are all (so far) on a solid enough basis to warrant our giving the space for an analysis.

William B. Daly, of Butte

ONE REASON for the efficiency of the operation of big railroads is said to be the ladder-climbing route taken by the executives. If you examine the record of the average big official you will probably find that he started twenty-five or thirty years ago as a brakeman or a junior clerk in the general offices, or as a station agent in some out-of-the-way place; from that lowly position he worked up through the organization. When he reached the top he had a background of practical railroading experience that stood him in good stead.

Much the same course was taken by William B. Daly, who on Feb. 1, became general manager of mines at Butte for the Anaconda Copper Mining Co. Twenty-five years ago Mr. Daly was working underground in one of the Anaconda mines. He served three years as mucker, miner, timberman. At various times he filled the jobs of surface foreman, time keeper, and mine foreman. He was made superintendent of the Bell and Diamond mines, superintendent of the Anaconda employment department, and in 1913 became efficiency engineer for all the mines.

The next year he was made general superintendent and in 1919 assistant manager of mines, the position that he now relinquishes. Since the war the Anaconda company's efforts have been directed principally to cutting production costs by reorganizing every detail of mine operation to get the most effective results. Mr. Daly has had direct charge of this work, under the supervision of John Gillie, veteran mine manager, who now becomes consulting engineer.

In Butte, Mr. Daly is credited with instituting changes that are saving thousands of dollars per day compared with the best performances heretofore. Natural engineering and executive ability, an appetite for hard work, and a faculty for getting along with people in high positions and low, have placed the one-time "mucker" in charge of the largest group of underground mines in the world. We feel sure that he takes the new job with the best wishes of everybody on "Anaconda Hill."

The Carson Patents

THE USE of reverberatory smelting furnaces in copper metallurgy began in historic times. The small reverberatory was introduced into western American practice in 1878 with the erection of the Argo plant at Denver. The modern copper reverberatory was developed by progressive steps. Its construction and design were the result of practice and the thought and experience of metallurgists and smelter men. Just who first introduced the side feeding of ore having for its objective the protection of the side walls of the furnace from the corrosive action of the slag and matte and the elimination of fettling through side doors has never been accurately determined. G. C. Carson and H. L. Charles both claim to have invented the method. The patents obtained by Mr. Carson were obscure and long delayed, due, in our opinion, to either his own carelessness or to the hazy ideas involved. It is admitted that Mr. Carson was unsuccessful in attempting to introduce his ideas or to make a practicable furnace. In the meantime the idea was developed by successive increments through practice until it is now generally used in all copper smelting reverberatories.

Mr. Carson's patents were issued finally on Aug. 10, 1915 (1,149,495), and April 29, 1919 (1,302,307), after the side feeding of copper smelting reverberatories had become established. Through his lawyers he began suit against the Afterthought Mining Co. and won, nominal damages of $1 being awarded to him. A second suit was started against the Tacoma plant of the American Smelting & Refining Co. The decision held that the Siemens patents invalidated the Carson patents. The Siemens patents were granted in Great Britain on March 20, 1867, and in the United States on April 11, 1871. In them the idea of feeding ore into a reverberatory through openings in the arch close to the side walls is specifically stated. Thus the invention of Carson was anticipated a number of years by prior patents. The fundamental idea of protecting the side walls of the furnace by siliceous ores was described by Peters in 1899. The combination of the ideas has the merit of novelty, but Carson appears to have overlooked this feature of combining known principles.

Group Spirit In Education and Industry

UNFORTUNATELY, there isn't room for every one at the top of the ladder of success. What, then, is the remedy for a condition of affairs that arises from an intensive application of the competitive spirit, resulting in the elevation of the few and the disheartening of the many? The answer may be found in the pages of a new book written by that most versatile of all modern authors, Mr. H. G. Wells—"The Story of a Great Schoolmaster." It discusses in particular the conception and evolution of an idea that was brought to fruition by F. W. Sanderson, late headmaster of Oundle, one of England's public schools. The logic of the idea can be proved by statistics of growth and success; and the underlying principle indicates so fine an appreciation of the science of education that the details are worth repetition.

Sanderson found, when he became headmaster of Oundle thirty years ago, that the competitive system was destroying initiative and checking ambition. The great majority of the boys, disinclined to make a special effort and realizing that they were mentally incapable of rising even in the direction of unusual distinction, contented themselves with the reward that comes to the mediocre. The study of experimental science suggested a remedy, and the group-activity system was developed, whereby the acquisition rather than the absorption of learning was encouraged. Competition among students gave way to a co-operative spirit that found expression in co-ordinated effort—for the good of the group. The mediocrity was then made to improve his standard, and the status of the school was raised, so that success attended the efforts of the majority rather than of the few spectacular individual achievement not being encouraged.

After the loss of his son on the battlefields of Europe, Sanderson turned his attention to the scope of his idea in the possibility of success from corporate service in industrial effort. He believed that the schools should lay the foundation of such a doctrine, whereby latent talent would be developed early, otherwise likely to remain dormant because of inability to aspire to the height of success reached by the few.

The tendency among the great men of the world is to submerge individuality in a catholicity of opinion and knowledge. Sanderson aimed to establish in his school a "Temple of the World," as he termed it—filled with "charts of all things and of all ages, including pictures of at least all the world's great men; then to turn a boy loose in it, thereby to realize his position in the world as a unit of its time, as opposed to the inculcation of any idea of his having a part in his nationality only."

The Institute Refers

HAVING WITHDRAWN from the Federated Engineering Societies, it has devolved on the American Institute of Mining and Metallurgical Engineers to take up questions of general policy by itself; and accordingly it has sent out a referendum for vote by all its membership. This is the first referendum which the Institute has sent out for some years. It would be pleasant and lively to have Institute referenda oftener. In the present case, it will be a matter of regret to many members that they are not asked concerning and be privileged to vote on some of the problems of the Institute. It is characteristic of mining engineers, however, that they like to go far afield in searching out topics for ballot. The present referendum is certainly a safe one. It asks whether or not the voter favors tax reduction. One is reminded on receiving the referendum of an idle jest discovered in a recent college publication. "What did you get for Christmas," is the question. "Say, do you know those long racing Cadillacs?" "Yes." "Well, I got a pair of roller skates." We predict that the average member will vote to have his taxes reduced. A ballot sent out asking for a vote on Institute dues would have the same outcome.

Those members who have already voted in favor of tax reduction in the *Literary Digest's* poll, who also voted aye in the polls conducted by their college alumni association, and a few other organizations to which they belong, may perhaps at this juncture pause to consider whether moral turpitude is involved in repeating, even in voting for a good cause like having our taxes lessened; and may hesitate in voting again on the Institute's poll. Or this latest opportunity to vote might be used as a conscience device, for by voting no on this ballot, one could cancel one of the thoughtlessly redundant aye votes one has already cast.

Liquid Oxygen Explosives and the Bureau of Mines

A TALK on liquid oxygen explosives was given recently at the Engineers' Club of San Francisco by Mr. S. P. Howell, superintendent and explosives engineer of the U. S. Bureau of Mines, to mining engineers and members of the California Metal and Mineral Producers' Association. Mr. Howell mentioned the important papers on the subject which have been printed, Clevenger's valuable article on the results at Pachuca and the compilation by the Bureau of Mines. He further said: "If you want our mining engineer to make an estimate of cost and to give details of the installation of liquid oxygen explosives, we would be glad to do it." If this statement signifies that the assistance of the U. S. Bureau of Mines is to be extended to the special needs of individual mines, it is a direct bid for professional service. Mining engineers appreciate an authoritative statement by the Bureau of Mines of the results of its experiments and investigations; but an encroachment on the field of the professional engineer is not popular.

Synchronous Motors —Their Widening Use

Possibility of Cutting Power Costs and Improving Operating Conditions Responsible for Their Increased Application in Mining and Milling.

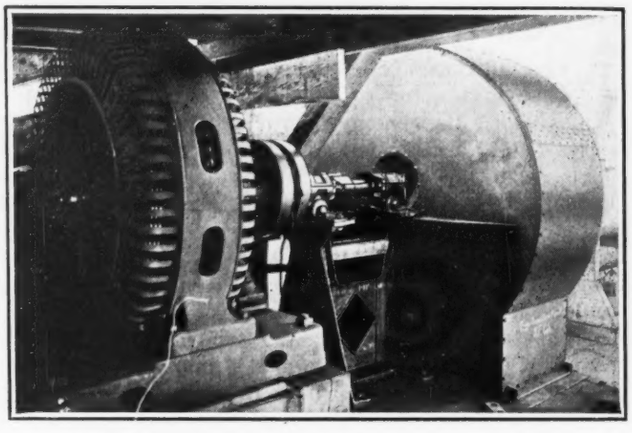
By Girard B. Rosenblatt
Electrical Engineer, Westinghouse Electric & Manufacturing Co.
San Francisco, Calif

Girard B. Rosenblatt

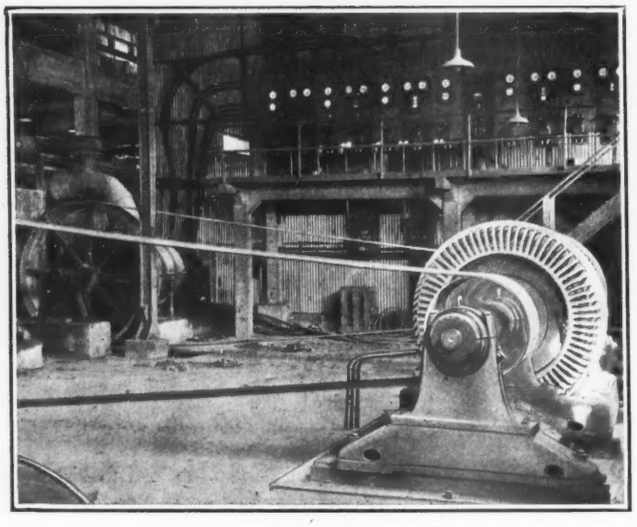
FROM the time when electric power was first used in the mining industry the induction motor has been the accepted means of driving mining and milling machinery. The fact that for many power applications in mining other kinds of motor drive might offer economic advantages was overlooked, partly through the lack of appreciation of advances that have been made in electrical design and in a measure through the tendency to adhere to accepted practice.

The power companies were the first to realize the operating difficulties imposed upon their systems by the increasing loads of induction motors operating at low power-factors, and many of them consequently began to encourage the use of synchronous motors, either by so arranging their power rates as to penalize loads entailing a poor power-factor, or by pointing out to their customers the advantages to be gained by the installation of synchronous electrical machinery. Finally many of the mining companies awoke to the fact that a high power-factor was a decided advantage to themselves, and those operating their own electric power plants began to appreciate that a high operating power-factor lowered their power-plant costs, reduced their over-all losses, and bettered their operating conditions. As a result, greater attention has been continuously given to the advantages of using synchronous motors, and with improvements in this type of driving equipment the field for its use in mining and metallurgical practice has steadily widened.

The synchronous motors that are now available are just as reliable and almost as simple as induction motors. Modern synchronous motors are easy to start, synchronize readily, and have good overload capacity and high efficiency. They may be most advantageously applied to many kinds of drives that are common in mining and metallurgical work.



250-hp. synchronous motor direct-coupled to exhaust fan



One of four 275-hp. synchronous motors belted to flotation blowers at the mill of the Chino Copper Co., Hurley, N. M.

The first widespread application of synchronous motors to mining machinery was in connection with the driving of air compressors. As compressors of large capacity came into vogue it soon became apparent that the use of a direct-connected motor would save material space in the surface plant, and would eliminate belt losses and the cost of belt maintenance. On account of the inherently low speed of compressors, it was not feasible to produce good induction motors economically that could be direct-connected. Consideration was therefore given to the use of synchronous motors for such power drives. It soon became evident that by proper design a slow-speed synchronous motor could be produced that would start readily with simple equipment and that would entail no special difficulty in synchronizing.

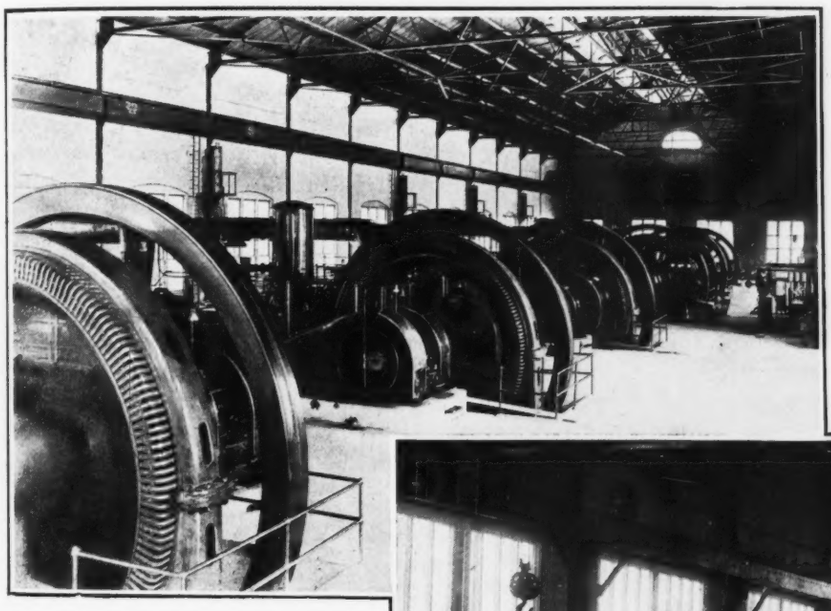
The success attendant upon the use of synchronous motors for compressor drives soon led to their consideration for the direct-connected drives of slow-speed plunger pumps of the Prescott and similar types, and several installations of this sort were made some years ago and have proved eminently satisfactory.

If the synchronous motor could successfully operate a plunger pump it was reasonable to suppose that it could also be applied advantageously to centrifugal

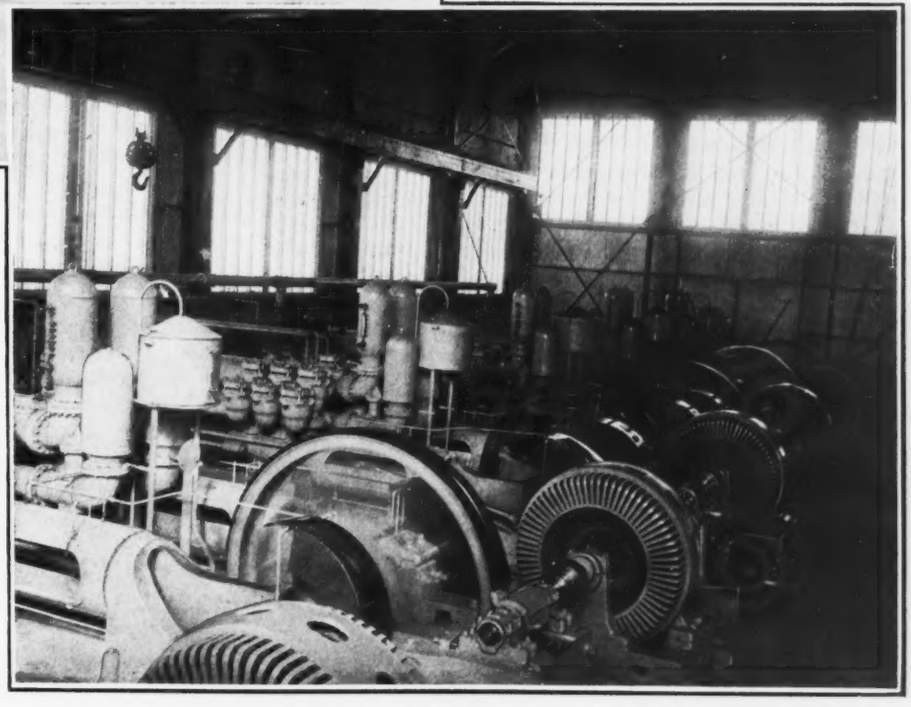
pumps. However, this application introduced a new consideration. In driving compressors and plunger pumps a considerable amount of torque is necessary at starting, to overcome the inertia of the driven machinery and to break its static friction. After the machine is once in motion a comparatively small amount of torque will suffice to bring it up to its rated speed provided it is not started against external pressure. The centrifugal pump, on the other hand, has small inertia and therefore starts easily, but it builds up its load requirement as it increases in speed, and therefore the problem does not involve starting difficulties, but necessitates a motor that can develop increasing torque after starting so as to have sufficient torque to synchronize readily when the pump is up to nearly full speed. Investigation proved that motors with high synchronizing torque could be produced satisfactorily and economically, and with the placing upon the market of this type of motor the synchronous drive for centrifugal pumps soon became well established. From the application of a synchronous motor to a centrifugal pump only a step was necessary to apply such motors to fans and blowers, and today one of the most common uses of synchronous motors in many industries is for driving rotary draft-producing equipment.

In concentrating mill practice, synchronous motors were at first used to drive line shafts from which the driven machinery was either belted directly or connected thereto by friction clutch pulleys and belts. It was at first considered that a synchronous motor did not have sufficient starting torque to permit of the direct driving of crushing, grinding, or concentrating machines. However, the development in connection with the compressor applications rapidly brought into consideration the economies that would result from the use of synchronous motors in driving mill machinery.

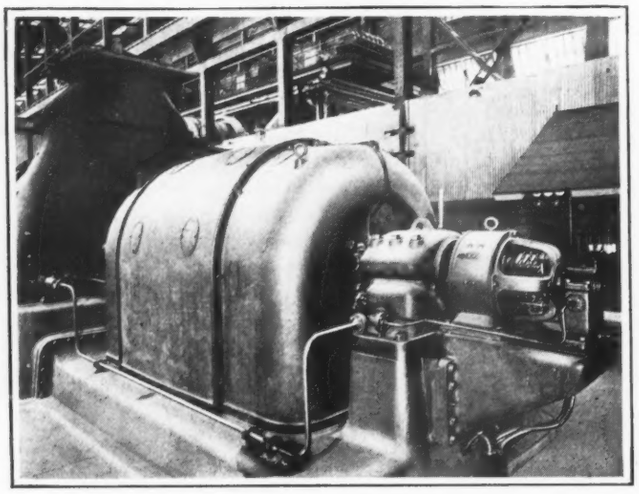
The Phelps Dodge Corporation was, I believe, the first to apply synchronous motors to roll drives in its Nacozari mill. The Alaska Juneau Gold Mining Co. followed this initial application soon afterward by using synchronous motors to drive its crushing machinery. In the meantime, cement mills, many of which were large purchasers of central station power, were being forced by the consideration of the question of power rates toward the application of synchronous motors for driving tube mills. Several such installations had been successfully made, when H. Kenyon Burch decided to use synchronous motors for direct-connected drives upon the rod mills to be installed at the new concentrating plant of the New Cornelia Copper Co. at Ajo, Ariz.



Eight 1,200-hp. synchronous motors direct-connected to air compressors, Butte Central compressor plant, Anaconda Copper Mining Co.



Six 300-hp. synchronous motors geared to Prescott pumps at the Burch station of the Inspiration Consolidated Copper Co.



1,700-hp., 6,600-volt, 1,500-r.p.m. synchronous motor direct-connected to 60,000-cu.ft. flotation blower at the mill of the Inspiration Consolidated Copper Co.

As a consequence, synchronous motors are now successfully applied to various drives in mining service, including compressors, plunger and centrifugal pumps, and ventilating equipment, and in concentrating mill practice their success has been proved in connection with the driving of gyratories, rolls, tube, rod and ball mills, and blowers for flotation work.

At present there are few constant-speed applications for which a suitable synchronous motor cannot be designed, and in general a synchronous motor will prove thoroughly satisfactory and particularly advantageous for direct connection where the speed of the driven machine is either very high or very low.

The application of synchronous motors to many drives, although entirely feasible and satisfactory, requires a close study of operating conditions in advance of decision as to type of motor. Success depends primarily on properly selecting the characteristics of the motor for the work it has to do. In general, for moderate speeds the synchronous motor is more expensive than an induction motor of the same rating. For very high or for very low speeds the reverse is, in general, true. In any event the margin of increased or decreased cost is not the only criterion.

The fundamental reason for using synchronous motors is the securing of plant operating economies. The only way to evaluate a machine is by the work that it will do, and the only exact basis of valuation in mining, or milling, is the cost per ton of ore mined, or per pound of metal produced. When the problem is considered from this angle the synchronous motor will often be found to offer many advantages in lower unit operating costs than can be obtained by the use of lower first cost power equipment.

British Guiana Diamond Mining Flourishes

Diamonds having a total value of $3,961,369 were mined in British Guiana during 1922, according to a report just issued by the Lands and Mines Department of that government. The report is authority for the following information. The output included 309,657 stones, weighing 61,037 carats. This works out at an average of five stones to the carat; the average value of the stones is about $24 a carat, based on customs declarations of exporters. Allowing for a few known cases of over-declaration, it would be safer to assume that the average local purchase price was nearer $20 a carat. Twenty stones declared weighed more than 10 carats.

The whole of the output was won by the local diggers to a number estimated as fluctuating between 7,000 and 10,000. The stones are eagerly sought by the representatives of English, American, and Continental firms of standing and by diamond dealers of diverse nationalities, who have opened purchasing agencies in Georgetown and in the diamond fields as well. The diamonds are quickly converted into cash, which in turn passes into local circulation. There is therefore much to be said in favor of the present method of working the shallow deposits, where practically every individual worker is sharing in the profits which accrue from his labor and healthy competition for the stones assures a price at which such labor is profitable.

Access to the district involves much hardship, expense, and danger. It is by way of the Mazaruni River. The stretch of this river which is difficult of navigation owing to the rapids and low cataracts, begins at Tutruba Falls, about 11 miles above Bartica, at the junction of the Mazaruni River with the Essequibo River, and ends at Tiboku Fall, about 70 miles up river, whence deep and uninterrupted water exists up to and far past the present workings.

The river traffic to the diamond fields during 1922 totaled 955 boats, each carrying an average of three tons of cargo to the diamond fields, or an aggregate of 2,865 tons for the year. The number of persons traveling to and fro may be estimated at a maximum average of 20 for each boat, including the crew, or 38,200 persons for the year.

The proved diamondiferous area of British Guiana extends in a northerly and southerly direction from the Potaro River to the Cuyuni River, a distance of 150 miles, and eastward for 40 miles from the foot of the Pakaraima Mountains. It has been estimated that, at the present rate of working, this area would last as a producer of diamonds for twenty to twenty-five years. This estimate is no doubt fully justified by the data acquired in respect to the parts of the total area which have been investigated; but a region 150 miles by 40 miles constitutes a large area, and a systematic geological and mineralogical examination is necessary before an accurate estimate of its potentialities can be given.

Modern Physical Methods of Prospecting

New methods of prospecting have been developed in recent years in Germany. These methods depend on the physical properties of rocks and minerals which act at a distance—namely, gravitation, magnetism, and radioactivity. Other methods are based on the electrical conductivity, elasticity, and di-electrification. These have been very successful, especially in discovering water-filled fissures in salt domes, in determining the boundaries of ore deposits of limonite, galena, pyrite, and chalcopyrite. The gravitation balance of Eötvös is used often successfully in determining salt domes and oil pools connected with salts. Four companies in Germany are solely engaged in such prospecting. The companies are working in Germany, Austria, Switzerland, Italy, Rumania, Czechoslovakia, and South America.

A Growing Field for the Mining Engineer

His Increasing Participation in the Non-metallic Mineral Industries Will Be Mutually Advantageous

By Arthur B. Parsons
Assistant Editor

ONE BIG ADVANTAGE lies with the folks who write the dictionaries; they address the task of defining each word with an open mind; ordinarily they have no preconceived notions to interfere with their work. With the layman it is different. Take mining for instance. It is the industry that involves the running of mines; but what is a mine? To the average person probably the essential features of a mine are: pitch darkness, where artificial lights are always needed; a subterranean opening beneath hundreds of tons of rock that may cave; and, of course, digging to recover gold, or coal, or copper, or some other valuable mineral. Indeed, many of us who ought to know better have been inclined to restrict the term "mine" to underground workings that are shut off from daylight except for small shaft or adit openings that serve as entrances. The honest-to-goodness miner generally takes a vast, even if peculiar, pride in working underground; he rates the open-cut drill runner, for instance, as a workman of inferior standing on the ladder of industrial labor.

Sunshine and fresh air are advantages of the open cut miner

It may be confessed, too, that a good many mine foremen, superintendents, and mining engineers—particularly those whose work had been in metal mines—used to look askance at what they called a "quarry" job. Their business was running mines, and they drew a sharp distinction between an underground "mine" and excavations to which the sun during the daytime usually was able to afford an adequate supply of light. These surficial workings were usually referred to by some other name, or at least the term mine was qualified. There were strip mines and open-cut mines and banks and pits and quarries. However, when in Minnesota the Mesabi open-cut iron mines came into prominence, and later, when we began to dig so orthodox a mine product as copper ore by steam shovel, there was a distinct change, and the best mining engineers in the country began to study the problem of efficient open-cut mining. It is universally recognized as an essential process in the metal-mining industry today.

An Unreasonable Prejudice

It seems, however, that a peculiar prejudice survives with respect to the mining of a large group of non-metal ores. Other reasons exist, but a contributing cause is this antipathy toward open-cut or quarry work. The attitude is unsound from every angle, particularly from that of the material well-being of the engineers themselves. The dictionary writers, from their position of judicial detachment, regard "mine" as a very comprehensive term. "A mine is an excavation in the earth made with the purpose of extracting useful minerals," seems to be a fair composite of the latest definitions. It is possible to isolate one comparatively small group comprising the mines of the "dimension" stone industries. These, literally, are quarries (from the Latin *quadrare:* to square—to hew); they include monumental stone, structural marble and slate, and building stone, the distinguishing feature being that the size and shape of the product is an essential factor in determining its value. For the purpose of this discussion the coal and oil industries also may be excluded because of their highly specialized character. The digging of every other metal and non-metal mineral, it seems to me, is mining in the strictest sense of the word. Each of them unquestionably "belongs."

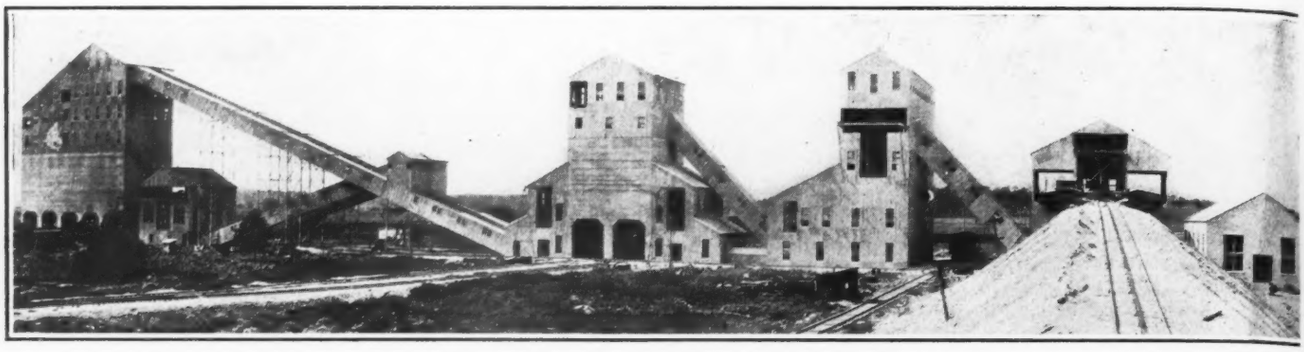
Ores of the metals, regardless of the method used in mining them, seem by tacit agreement to be included in the charmed circle. Fluorspar, pyrites, graphite, asbestos, and talc have pretty good standing, but the position of most of the other "non-metallics" is far from secure. For convenience I have listed most of them here:

Limestone	Marble	Borax
Traprock	Slate	Tripoli
Granite	Feldspar	Nitrate
Sandstone	Fullers Earth	Sulphur
Gypsum	Phosphate	Oil shale
Sand	Clay	Kaolin
Gravel	Asbestos	Fluorspar
Barytes	Salt	Graphite
Bauxite	Garnet	Pyrite
Ochre	Chromite	Mica
Silica	Magnesite	Talc

I hope in this article to point out certain sound reasons why the mining engineer should make these minerals his particular concern, and to indicate various trends that will make the exploitation of them of steadily increasing importance in his business.

Broad generalizations are sure to be inaccurate in that they do not apply to all of a group. With this qualification, it will be safe to enumerate some of the reasons not only why this field offers special opportunity for the mining engineer, but why it will benefit from his activities:

1. The quantity of these ores mined is immense. The aggregate output exceeds both in tonnage and net



Near Gary, Ind., the Dolese & Shepard Co. mines and crushes 800 tons

value the output of the metallic ores by a good margin.

2. The technical and engineering methods for mining and preparing the products represented are not so advanced as the comparable methods used in metal mining. To this there are notable exceptions.

3. The mining engineer has specialized in the processes of drilling, breaking, conveying, loading, hauling —basic operations of any mining enterprise, be it open-cut or underground.

4. He is accurately informed as to the construction, use, and selection of the most efficient machinery, equipment, and supplies for doing the things mentioned.

5. A definite tendency is discernible toward the mining by underground methods of some minerals that heretofore have been obtained largely by surface operations. This is the logical consequence of the gradual depletion of the supply of high-grade mineral deposits near the surface. As the thickness of overburden increases the economic equation obviously leans toward the side of underground work.

6. The mining engineer's experience has taught him the best methods of crushing and dust collecting; of washing, screening, classifying, concentrating, grinding, elevating, filtering, and drying mineral products.

7. Although the problems involved in the dressing of some non-metallic minerals are peculiar, and frequently demand new and unusual adaptations of ore-dressing processes, the specialized skill of the metal-mining engineer is a great asset in applying these processes and in selecting the equipment. He has a back-ground of many years of research and experiment that is applicable and that is lacking in many of the non-metallic industries. He knows the wisdom of replacing inefficient equipment when better is developed and manufactured.

Limestone mine of J. B. Speed & Co. at Milltown, Ind.

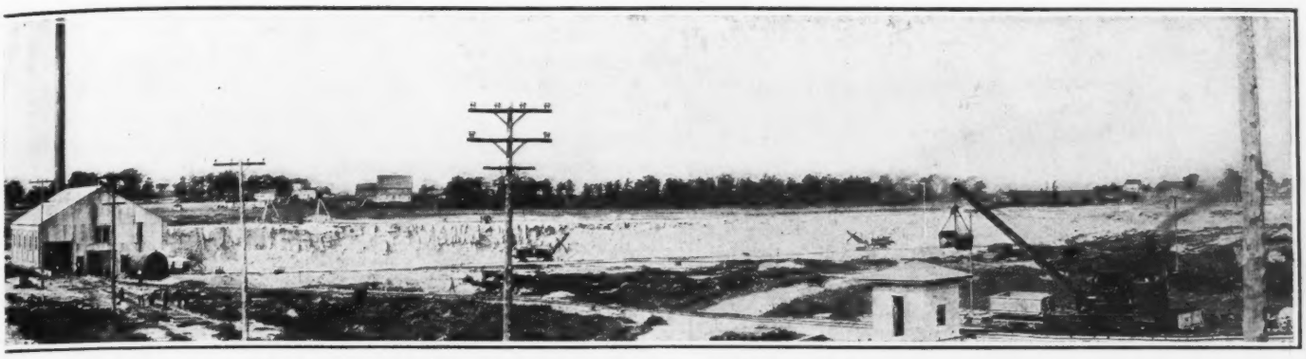
8. There is a growing tendency in the direction of better ore-dressing methods or in some instances of the introduction of ore dressing where virtually none has been practiced heretofore. This may be accounted for in part by the desire to get a higher-grade product, and in part by the necessity for improving processes to maintain a product of given grade from the treatment of a lower-grade ore from the mine.

Underground Methods Displace Open-Cut

This last is a sort of corollary to (5) above. The highest-grade deposits nearest the surface are ordinarily mined first. There remain (a) deeper deposits of high grade, or (b) leaner deposits at the surface. In the natural sequence of events either more complicated mining, or more complicated dressing, and ultimately both, may be expected. Here again it must be remembered that this is a generalization. However, an almost perfect practical illustration can be found in the history of iron-ore mining on the Mesabi Range.

Here is a good place to disclaim any intention of disparaging the accomplishments of the men who are in charge of non-metallic mineral operations. It seems to me that any man who is doing a first-class, efficient job mining and crushing limestone for railroad ballast is a successful mining engineer, just as logically as if he were running a silver mine successfully. Nor does it make any difference whether he was graduated as a civil or mechanical engineer or if he missed entirely that step in engineer-making represented by four years' attendance at a university. Nevertheless, the statement will hardly be disputed that metal-mining companies have made remarkable progress in the development of economical and systematic methods for mining, handling and dressing mineral products. With the assistance of manufacturers they have devised an unusual number of special machines to perform essential operations. If the engineers who have been trained in the application of these methods can show the producer in any branch or branches of the non-metallic industry how to save money, or earn more money, their services certainly will not go begging.

I shall now mention briefly some phases of the exploitation of a few of the non-metallic minerals to show how the generalizations apply to them.



of limestone per day. The rock is steam-shoveled from the pit at the right

Limestone, Traprock, Granite—These three comprise the bulk of the output of the "crushed stone" industry. This term includes the mining of rock for a number of purposes, the most important being (1) the burning of lime, (2) manufacture of portland cement, (3) agricultural limestone, (4) fluxing material for furnace charges, (5) concrete aggregate, (6) railroad ballast, (7) road building. This list is sufficient to impress one with the huge tonnage of raw material consumed. The methods and the equipment used for mining, crushing, sizing, washing, and handling are identical with those used in many kinds of metal mining. Possibly I should turn this statement around and say that the methods of metal miners resemble those of the stone industries; some might contend that, so far at least as open-cut mining and large-scale crushing are concerned, the metal miner has adopted the methods of the "stone miner" or the quarrier. However, nothing is to be gained by arguing this question; it is strictly a family matter. The lexicographers have established consanguinity, and "mining" includes the exploitation of traprock as surely as of copper. The only point is the one I want to emphasize: that the operations, the plants, and the equipment required are virtually identical.

A Modern Underground Limestone Mine

The growing tendency toward the adoption of underground mining methods is of more importance than many appreciate. There are at least fifteen good-sized underground limestone mines; one in Missouri has about four miles of workings. It is significant that most of the mines have for their purpose the extraction of the downward extensions of deposits that have long been operated by open cut. A typical example is the work of the American Lime & Stone Co., at Bellefonte, Pa. The stratum of high-grade limestone is about 75 ft. thick and is inclined at an angle of 50 deg. Some years ago operations reached the point where it became more economical to mine portions of the deposit by underground methods. An important factor was the avoidance of the contamination with impure rock which accompanied open-cut work. A three-compartment inclined shaft was sunk in the footwall about 75 ft. from the stratum to be mined. Underhand stoping, mechanical loading, and electric haulage in the drifts are employed. Five-ton skips, in balance, load automatically. No timbering is required except in the main shaft.

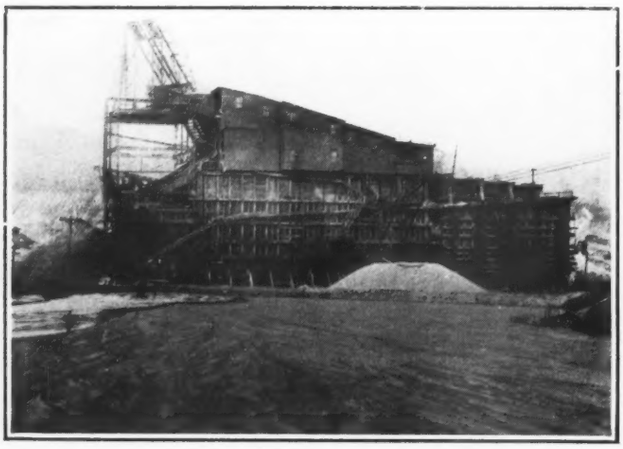
Obviously, cheap mining must be used in any limestone mine. There will be an opportunity for the use of shrinkage stoping and other low-cost methods; to apply these methods in the increasing number of places where they inevitably will be required is going to give the underground mine operator who understands his business plenty to do.

The treatment of crushed stone after it has been delivered at the crushing plant depends somewhat on the use to which the product will be put. Crushing and sizing are always required; concrete aggregate is often washed; agricultural limestone is ground. In addition there is the all important problem of efficient handling by means of conveyors, elevators, feeders and loaders of various types. The trend is toward further mechanicalization of the entire treatment process, with a view to reducing the labor cost. Here surely is a growing field for the engineer.

Gypsum—During 1922 the Geological Survey estimated the value of gypsum produced in the United States at $30,000,000, the most important uses being for plaster and the manufacture of "non-supporting" building tile. A large proportion of the gypsum produced comes from strictly underground operations, where the deposits are located by drilling and do not outcrop. Those in western New York are typical of this kind of deposit. Room-and-pillar mining through vertical shafts is employed. The usual coarse-crushing processes are required; in addition, grinding in ball mills is increasing, as is the use of rotary calciners.

Sand and Gravel—Perhaps the most significant development in the sand and gravel industry is the grow-

Steel headframe and ore bins at the Bellefonte mine of the American Lime and Stone Co.



This plant on Long Island will wash 4,000 yd. of sand per day

ing demand for high-grade products. Sand that is properly sized and thoroughly washed serves its purposes much better than inferior grades. The consumer is appreciating the fact and the miner can afford to spend the money needed to prepare his product properly. Gravel is used principally as a concrete aggregate and for road making; besides the building industry, important uses of sand are glass making, molding material for foundries, and track-sand for locomotives. Besides trommels and screens, washing devices, classifiers (both mechanical and hydraulic), and even concentrating tables are finding a place in sand-dressing plants. More of these plants will be built, and the services of engineers who have had long experience in dressing metalliferous ore should be employed with mutual benefit to themselves and to the companies for which they work.

As sand and gravel come typically from surface deposits, mining is generally done by dredge or some type of grab-bucket installation, if under water; or by any economical method for excavating loose material. The deposits of sand are distributed fairly well, but the growing demand for a superior product warrants the construction of larger and more permanent mining and dressing plants, even though the output must be hauled considerable distances by rail.

Developments in Asbestos Mining and Milling

Asbestos—Although only a small proportion of the asbestos produced to date has come from underground operations, this method is certain to become increasingly important as the deeper part of the deposits are mined. At least one mine in the Thetford district, in Quebec, uses a typical shrinkage-stope system of mining; and mill-holes, underground haulage, and hoisting in shafts have been adopted in connection with the pits in several instances.

The milling of the ore and the separation of the fibre has been one of the unique ore-dressing operations, requiring special "fibreizing" crushers and collecting equipment. However, a process is being developed with good prospect for success that involves the use of ball mills for wet crushing, with separation by special devices and subsequent dewatering of the fibre by vacuum filtration.

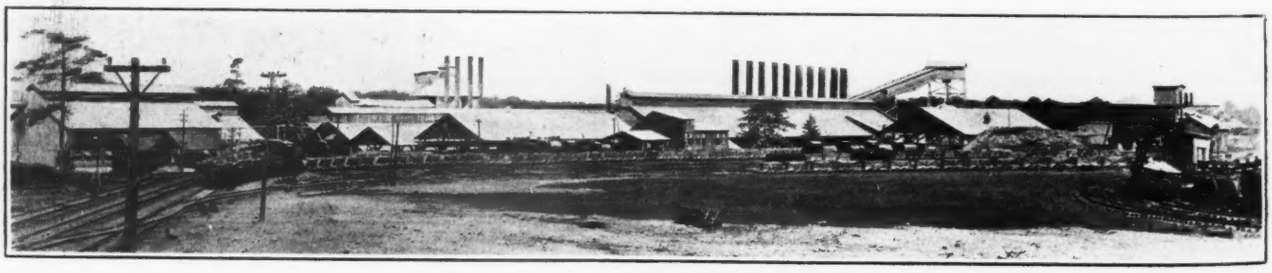
Barytes — Georgia and Missouri are the principal states producing barytes. In the Cartersville district, in Georgia, the deposits are large and comparatively uniform, and steam shovels are used advantageously for mining. A washing plant erected by the Bertha Mineral Co., a subsidiary of the New Jersey Zinc Co., is a thoroughly substantial structure equipped with log washers, trommels, and Harz jigs and all the auxiliary equipment of a modern concentrating plant. Concentrating tables are being used for recovering some of the finer material. The manufacture of lithophone has be-

Lowering a shovel into an open-cut limestone mine near Chicago

come the most important use of crude barytes. Ground and bleached barytes is prepared in Missouri, where tube mills, classifiers, settling tanks, and driers are used.

Bauxite—Open-cut mining with steam shovels is conducted in the bauxite mines in Arkansas. Steam locomotives haul the ore to the crushing, drying and calcining plant. The plant of the American Bauxite Co., the largest in the country, is equipped with efficient devices for mechanical handling of the material through the successive stages of treatment. About three-fourths of the bauxite mined in the United States goes into the manufacture of aluminum, so that the growing use of that metal should eventually increase the exploitation of domestic deposits in other parts of the country.

Ocher—Though ocher mining is a small industry, it is significant that at Cartersville the Georgia-Peruvian company, after mining in open cuts as much of its deposit as it economically could, is now operating a genuine underground mine. Square-set timbering is used, and a visitor can readily imagine himself in a western silver mine. This bears out my general state-



Crushing, drying and calcining plant of the American Bauxite Co. in Arkansas

Feldspar is ground wet in this plant of the Clinchfield Products Co. at Erwin, Tenn.

ment that increased use of underground mining for non-metallic minerals is inevitable. In the last two years hydraulic and mechanical classifiers and continuous thickeners have been installed for separating sand and fragments of quartzite and barite from the ocher which is recovered as a slime.

Feldspar—A mild revolution in milling practice has featured the feldspar industry during the last two years. From laborious hand cobbing, buhr-stone crushing, and dry grinding by batches in a tube mill, has been developed a process including breaking in a jaw crusher, continuous wet grinding in pebble mills in closed circuit with rake classifiers, vacuum filtration,

New plant for hoisting and dressing rock salt at Retsof, N. Y.

and drying on a hearth with mechanical stirrers. Moreover, mica is removed on vibrating screens and garnet and other undesirable impurities are separated on concentrating tables, thereby making possible the treatment of lower-grade material without expensive cobbing. An additional advantage is the avoidance of dust losses. Only one plant of this kind has yet been built, and continuous dry grinding with pebble mills in closed circuit with air separators has its advocates. However, it seems reasonable to predict that eventual development will be in the direction of wet treatment. All of the equipment in the plant mentioned comes directly from the field of the metal-mining engineer, even the drier having been designed in the first place to handle flotation concentrate.

Most feldspar mines are comparatively small and shallow surface excavations, but, as progress is made in treating the ore, larger and lower-grade deposits will be mined with more elaborate equipment for handling the output.

Salt—At Retsof, N. Y., the Retsof Mining Co. mines rock salt from a 10-ft. horizontal bed lying 1,000 ft. below the surface. The company has just finished a new mining and milling plant with a capacity of 3,000 tons per eight-hour shift. The shaft is lined throughout with concrete. Equipment underground includes twelve electrically operated loaders, electric locomotives for haulage, a rotary dumper, jaw crusher, and automatic skip-loading devices; and in the breaker, as the surface plant is called, pulverizers, screens, and miscellaneous mechanical handling equipment. I understand that the largest single order of magnetic vibrating screens ever filled went to this plant. An important feature is that the use of more and better arranged machinery in the new plant will make the labor cost half that in the old one which it displaces. Incidentally the salt is not refined for table use, but supplies various industrial needs, the ice-cream industry being very important.

Garnet—The principal natural abrasive produced in the United States is garnet, most of which is mined in the North River district in New York. The newest mill and concentrator has an orthodox jigging plant in which ten to fifteen tons of concentrate per shift is made by separating garnet from hornblende, quartz and feldspar.

Phosphate—Both in Florida and Tennessee phosphate is mined in open cuts, either by hydraulicking methods or by steam shovel, drag-line or cantilever excavators. However, in Tennessee are found large deposits of high-

Mining phosphate rock in the Mount Pleasant district in Tennessee

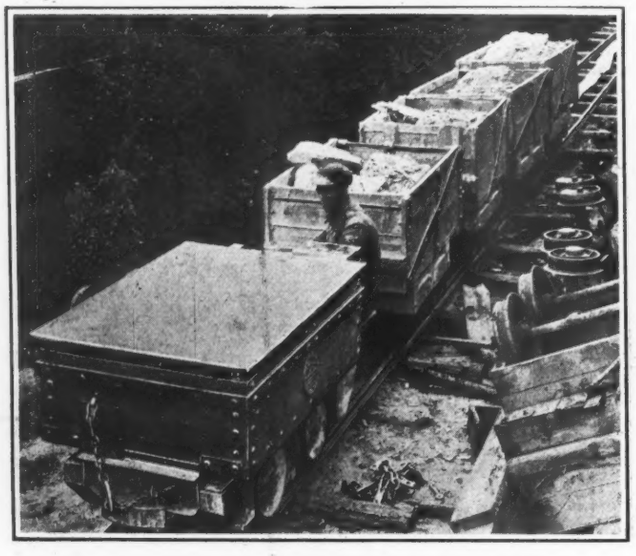
grade "blue" phosphate that must be mined by underground methods. The beds, nearly horizontal, are comparatively thin, but they are regular and extensive and eventually will be mined on a huge scale. At Conda, Idaho, the Anaconda company is mining phosphate rock from steeply pitching beds 8 to 10 ft. thick by underground operations. Equipment includes air-operated "mucking" machines, ten-ton steel cars, and electric locomotives. The rock is crushed at Conda to pass a ¾-in. screen, the capacity of the mine and plant being several thousand tons per day.

In Tennessee and Florida effort is being directed toward the recovery of the fine phosphate which is lost in the old-style washing plants. Modern classifying, dewatering, and screening equipment and concentrating tables are to be found in newer plants. Improvement in this direction offers an excellent opportunity for technical development on the part of the ore-dressing engineer.

In North Carolina and in Georgia, mica is being stoped by the usual underground methods; the same is true of talc and graphite in New York and other states, of gilsonite and other hydrocarbons in Utah, and of bentonite and borax in California, and comparatively small industries are prone to grow!

Problem Is to Cut Production Costs

Other examples might be given: these that I have mentioned are sufficient to indicate a definite trend in certain directions: (1) Toward the use of underground mining methods. (2) Toward increasing the size of many open-cut mining operations, thereby warranting more thorough and better paid technical direction. (3) Toward the substitution, in both kinds of mines, of mechanical equipment for hand labor; this entails closer attention to engineering management. (4) Toward the treatment of raw material of lower grade, which requires more elaborate treatment processes to obtain a product of acceptable quality. (5) Toward the preparation of a better product and a more uniform product, which also calls for improved ore-dressing methods. (6) Toward the use of more modern equipment and machinery in treatment plants; this is the consequence of (4) and (5) above and also of the growing realization on the part of owners and operators that in this direction lies the best chance for cutting production costs.



Storage battery locomotive hauling talc at Waterbury, Vt.

Mining mica underground at Canton, Ga.

Sufficient progress has been made to demonstrate the practical advantage to be realized. The inertia that retards the introduction of new practices of any kind in any industry is slowly being overcome but as yet little momentum has been attained. This makes the opportunity for the experienced engineer more attractive, for the field in many respects is unoccupied.

It is trite to say that the true function of the engineer is to increase profits; but just as soon as he shows that he can do so, he will be welcomed by the *entrepreneur* in the non-metallic industry. The machinery, the equipment, and the processes that are the every-day tools of the mining engineer are required; to select them and to show how they can be used to the best advantage in large, essential, and well-established industries is an opportunity that he cannot afford to ignore.

Hugo Stinnes Promoting a New Oil Trust

The concentration of German industry goes on. A few weeks ago a new German oil trust was promoted by Hugo Stinnes. He combined three important petroleum producers of Germany under his direction: The Riebeck'sche Montanwerke, the Aktiengesellschaft für Seeschiffahrt und Ueberseehandel, and the Aktiengesellschaft für Petroleumindustrie (Api).

The Riebeck'sche Montanwerke are important producers of mineral oils and paraffin from bituminous lignites. In 1921-22 this company produced 26,600 metric tons of mineral oils, and 9,700 metric tons of candles, paraffin, and mineral wax. The output of lignite amounted to 6,300,000 metric tons; of tar to 34,273 metric tons.

The Api was founded in 1896. It owns the famous Bergin patents, methods which make it possible to liquefy coals into oils. For this purpose a modern plant with a capacity of 100,000 metric tons yearly was built near Heidelberg. The company controls also a great number of refineries, storage plants, and oil fields in Hanover.

The Aktiengesellschaft für Seeschiffahrt in Hamburg possesses tank-ships, storage, and distribution plants, oil fields in Argentina, and controls a number of trading companies. Thus this new trust combines the production of coal, lignite, oil, and the refining and distribution of its own and other products.

Peripheral-Discharge Cylindrical Mills

Exit Pulp Flow Through Trunnion Has Disadvantages—
Development Shows Progress in Recent Years

By A. W. Allen
Assistant Editor, *Journal-Press*

CLOSED-CIRCUIT operation of an ordinary ball or tube mill has been shown to give the best results. Final-passage crushing is impracticable other than in exceptional instances, particularly if fine grinding is not needed or if a carefully graded product

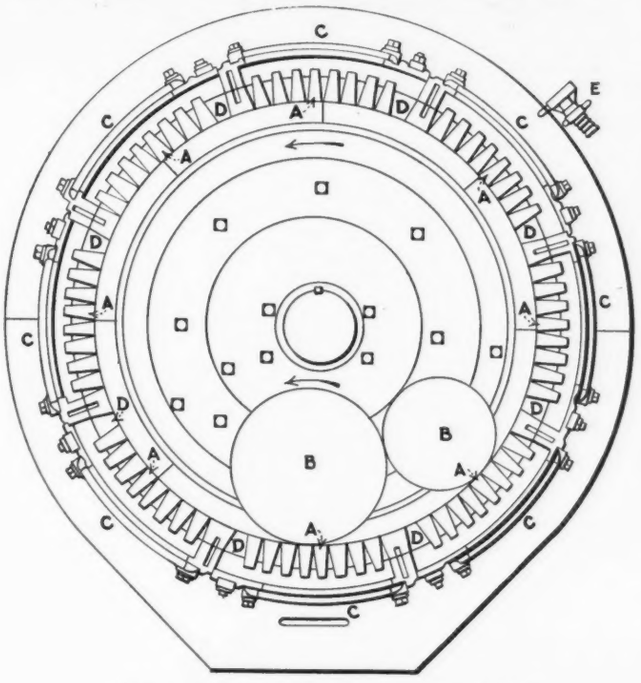


Fig. 1—Diagrammatic representation of a Tustin mill

is unnecessary. With closed-circuit grinding, on the other hand, the classifier used in conjunction with the mill permits the removal of material that is ground sufficiently fine. The grate in some types of ball mills was designed originally with the idea that it would act as a screen, whereby a classification would take place, the oversize being retained in the mill until able to pass through the apertures; but the contention is now generally accepted that the underlying assumption was illogical. If particles of ore have reached the discharge end of the mill without having been ground to the required size, nothing will be gained by retaining them there, where no provision exists to handle more than the normal flow. Grates, where provided, serve primarily for the purpose of retaining the grinding media in the mill and preventing their escape into the channels of discharge provided for the exit of the pulp.

Although exterior classification of pulp has proved a desirable adjunct to trunnion-discharge milling, it is evident that the necessity for auxiliary apparatus arose in the first place because of the difficulty of adjusting single-passage grinding to suit exactly the requirements as to character of final product, involving, as it does, low feed tonnage, high consumption of grinding media, and excessive wear at the discharge end of the mill. Further, in an effort to keep the discharge below a fixed maximum screen size, some of the material is ground too fine, and the expense and disadvantage is obvious. Hence the logic in an ample feed, closed-circuit operation, and exterior classification of pulp.

However, even in efficient trunnion-discharge operation it is evident that a proportion of the feed that enters the mill is sufficiently fine for discharge, or nearly so. No mechanico-hydraulic classifier works at 100 per cent efficiency. The undersize that enters with the feed must pass along the entire length of the mill before discharge is effected, whereupon unnecessary grinding occurs and efficiency is reduced. The near undersize is ground to the required size long before it can escape, thus clogging the mill and consuming power to no good purpose.

The earliest type of cylindrical mill probably consisted of a barrel, with pebbles or iron balls, in which a charge of ore was ground for a definite interval of time, operation being by the batch method. A door around the periphery was then opened and the contents were allowed to drain out, the grinding media being retained by a grid or screen. In the early application

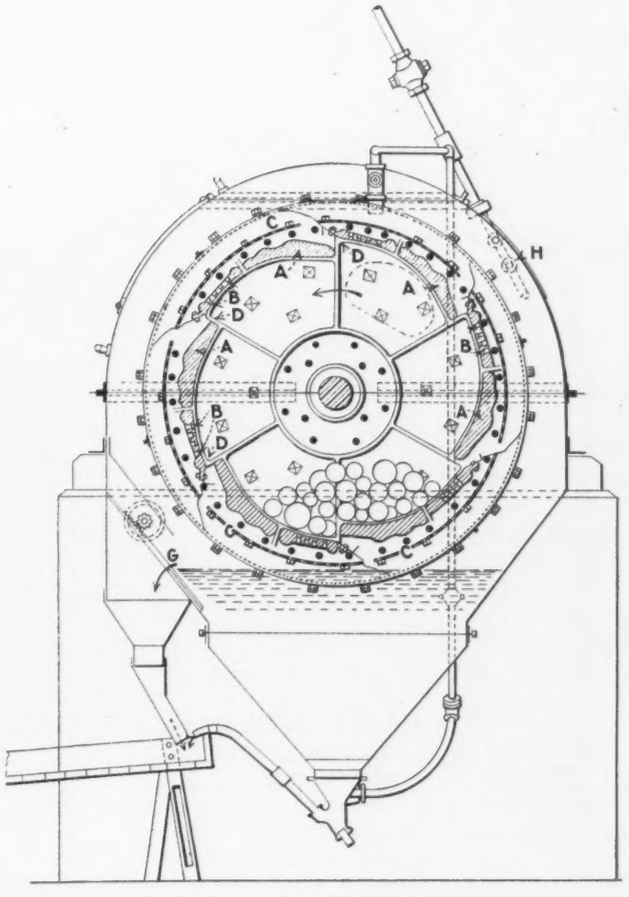


Fig. 2—Wet Krupp mill

of continuous grinding in a cylinder the idea of peripheral discharge of a screened product was a feature, the raw material being fed through an opening in the trunnion.

The Tustin mill (Fig. 1), one of the earliest of the continuous-operation, peripheral-discharge series, consisted of a cylinder on trunnion bearings. One of these was hollow, to facilitate the delivery of ore and water. The grinding surface of the mill proper consisted of eight sections of die ring (*A*), with tapered, slotted holes. The grinding was done by means of two cylindrical rollers (*B*), each the width of the interior of the mill (18 in.), and about 19 and 14 in. diameter, respectively.

The crushed ore, after passing through the perforations in the die ring, fell onto a series of fine screens (*C*), arranged peripherally, the oversize passing back into the interior of the mill via return ports (*D*) in the dies. An attempt was made to keep the screen clear by the provision of a spray of water directed on the outer surface (*E*); but the weakness of the design is seen in the fact that the diluent supplied to the interior of the mill runs out through the screens as fast as it is added, and other disadvantages are obvious.

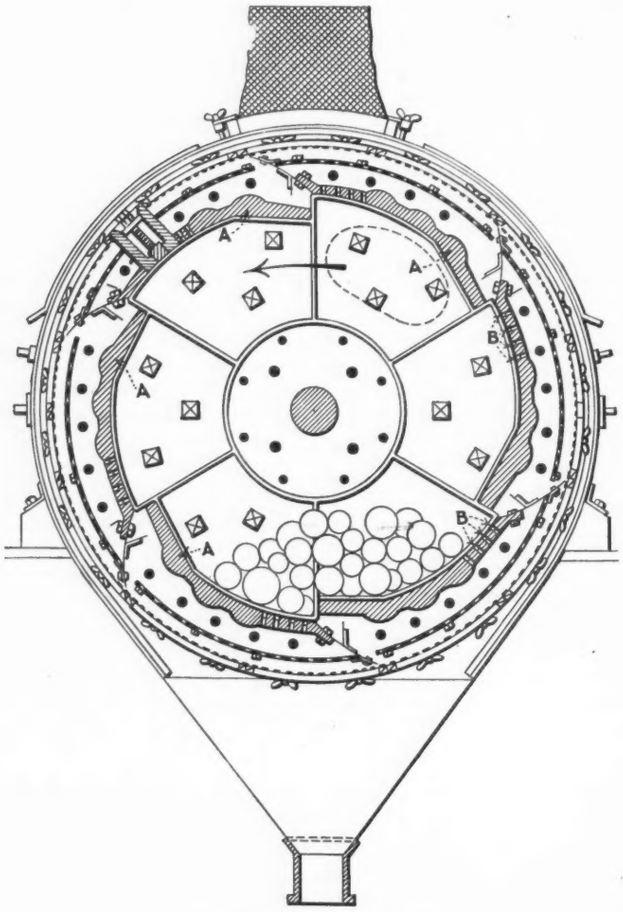


Fig. 3—Dry Krupp mill

The wet Krupp mill (Fig. 2) was the first to adopt a logical system to insure the submergence of the screen in water, and adequate provision for the automatic delivery of sufficient diluent into the interior of the mill. The ore is fed through a trunnion opening. The mill consists essentially of a narrow cylinder, lined with

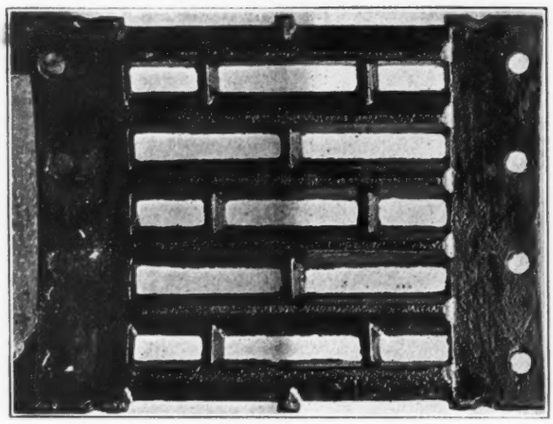


Fig. 4—Liner of Herman mill

steel wearing plates, arranged in the form of steps. These are provided with tapered perforations (*B*), through which the crushed ore passes, falling on a scalping screen (*C*), the oversize from which returns to the interior of the mill through perforated plates, underneath the liners, at (*D*).

The ore that passes through the coarsely punched screen falls onto the outer screen, and the oversize passes back through a series of apertures and joins the oversize from the coarse screen, both going to the interior of the mill. The deflector that carries back the oversize also acts as a scoop, taking up a supply of water at each revolution and keeping the mill flooded. This water comes from a spitzkasten classifier, which forms the lower part of the mill casing, the water level being maintained constant by the provision of an adjustable gate (*G*). Additional water is provided, to clear the outer screens, in the form of sprays (*H*).

The disadvantages in the wet Krupp mill are seen in complication of design, the burring of the discharge holes in the liners, necessitating frequent reaming, and the difficulty in operating it with an ore that varies appreciably in physical characteristics. The screening action is remarkably efficient. A temporary excess of fine material in the feed, which passes through immediately, will result in pounding; a temporary diminution in fines, or rather a temporary increase in the amount of hard rock, will result in an accumulation in the mill, inefficient work and the necessity for a stoppage of the feed. Given a crushed ore of even and regular char-

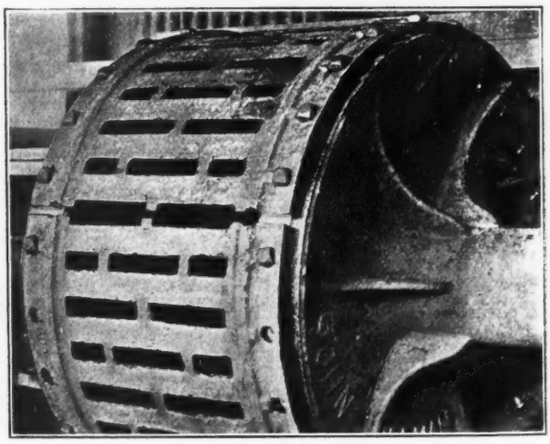


Fig. 5—Exterior view of Herman mill during assembling

acteristics, however, the mill does excellent work. The release of ground material is immediate, and a carefully screened product results, with a minimum of fines. The disadvantages of a cone classifier, running wet, are too well known to mill operators to need emphasis or repetition. This adjunct to the Krupp wet mill has deflected attention from its more favorable features. The idea underlying the operation of a mechanical classifier should have been adopted for the removal of the coarse material.

The dry-crushing Krupp mill (Fig. 3) is similar to the wet machine, except that there is no provision for water supply or exterior classification of the pulp; a space in the top of the casing leads to dust-collecting equipment, the bottom delivering direct into a bin, screw, or push conveyor. This mill has proved easier to operate than the wet machine, and has found wide application for the crushing of hard refractory gold ore, prior to roasting treatment. The consumption of steel in this mill is also much less than in the wet machine.

The next step in the development of the idea of peripheral discharge was the simpler construction. The Herman mill marks a distinct improvement in this respect, although it lacks the provision made in the wet Krupp mill for the supply of an excess of diluent by the scooping action of the cylinder. The inner part of the mill consists of a lining of reversed grizzly grids (Fig. 4). Over this comes a punched metal screen of boiler plate, which is covered by a fine screen, held in position as shown in Fig. 6. The usual load of balls is used, the feed being delivered through one of the trunnions in the customary manner. The shape of the grizzly liners is such that the smaller balls lodge in the depressions and take a proportion of the wear from the other balls, much in the same manner that the El Oro or Osborne liner functions in a tube mill.

The fundamental disadvantage in all the types of mills discussed is seen in the fact that the use of steel balls necessitates some type of shell liner, through which the ground material must pass. Small holes are liable to burr, requiring reaming at intervals; large holes permit the passage of coarse material and the speedy wearing of the outer screens. Further, the provision of holes of any type weakens the liner.

The introduction of the rod mill opened up new avenues for research. In most of the large rod mills in operation today the rods rest throughout their length on shell liners and on themselves. It was realized that if the rods were cradled it might be possible to avoid so extensive a contact between rod and shell liner. If, as Haultain and Dyer have shown, grinding in a ball mill is due mainly to slippage rather than impact, it is reasonable to assume that the same is the character of the work done in a rod mill.

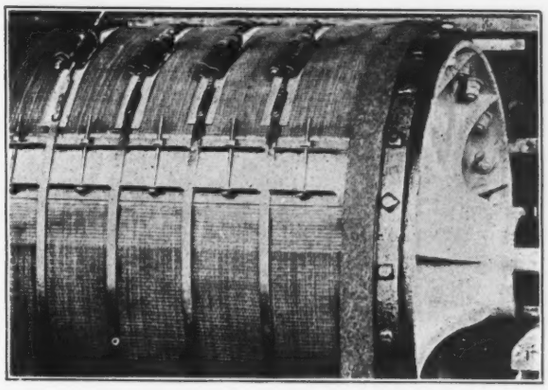


Fig. 6—Outer screen, Herman mill

The most recent development along these lines, the Forrester-Rexman mill, is a distinct novelty; extensive contact between grinding media and liner is avoided, and it is possible to arrange the screens around the periphery of the mill with the knowledge that the classification of the crushed ore will not be hindered by the presence of the grinding media. Rods are used, bunched or cradled in the manner shown in Fig. 7. An additional advantage of cradling results in a significant decrease in power consumption, a balanced unit being produced.

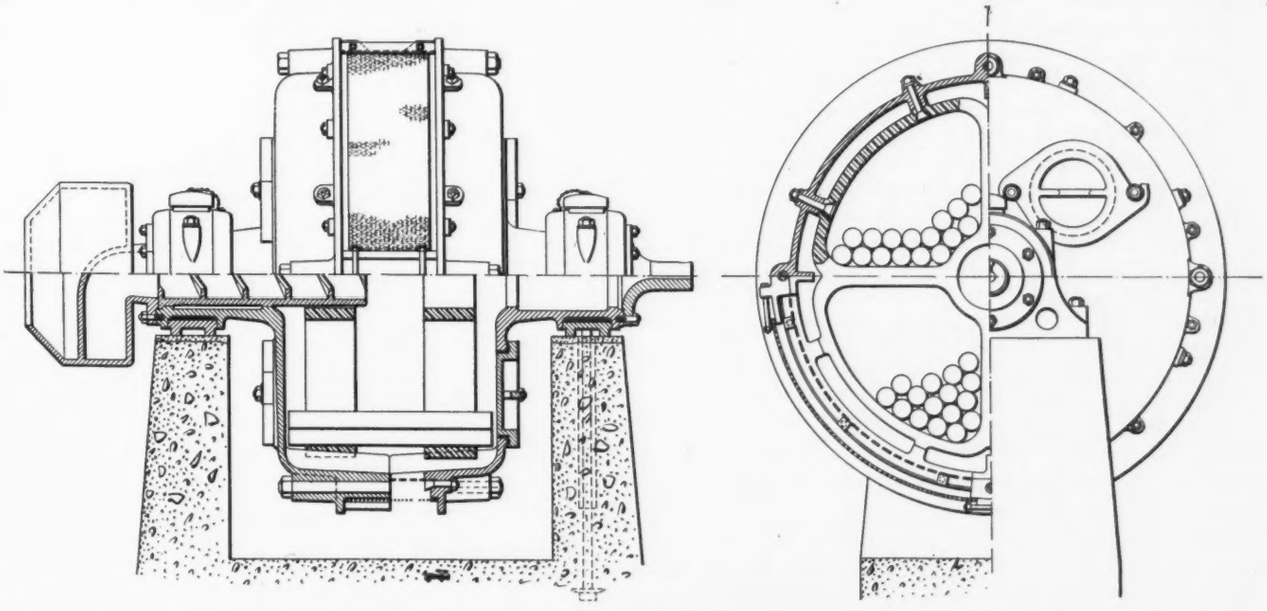


Fig. 7—Forrester-Rexman mill, showing arrangement of grinding rods

The feed, of the usual ball- or rod-mill size, is picked up by a trunnion-extension scoop. If wet crushing is being practiced, water is added at the same time. The pulp then passes, by means of a delivery tube with spiral feeder, to the center of the mill—to a chamber with outlets to four compartments. These, as shown in Fig. 7, are distinct from one another only so far as the rod load is concerned. The ore pulp is free to pass into any part of the interior of the mill, but the crushing rods are separated into four distinct bunches by a spider protected with liners. The rods impinge against the spider at two points only, where liners support them at short distances from the ends of the mill. There is no evidence of more wear on the rods where they touch the cradle liners than at any other part of their length.

The pulp discharges from the distributing chamber onto and between the falling rods, the revolution of the mill insuring fracture and abrasion in the ordinary manner. The rods maintain a horizontal position, parallel to each other at all times, except when the mill is temporarily overfed. The ore as crushed passes to the bottom of the mill, where it comes in contact with the coarse screen; and operations from then on are similar to those described for the Krupp mill, except that the oversize from the outer fine screen passes back to the center of the mill through the space shown in the halftone (Fig. 8). The mill pictured is driven direct from a countershaft by chain and sprocket, the small amount of power required making this method feasible.

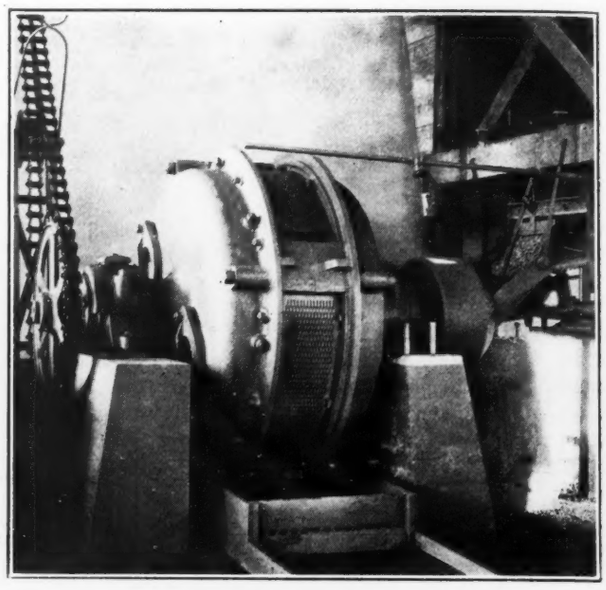


Fig. 8—Balanced rod mill, with outer screens removed

Attractive Possibilities of Mining in Turkey

ALTHOUGH no comprehensive geological survey has ever been undertaken in Turkey, it is generally thought and can hardly be doubted that the country possesses vast mineral wealth, says a report of the U. S. Department of Commerce. Some of it, such as coal, chrome, emery, lead, copper, boracite, meerschaum, salt, marble, mercury, antimony, and gypsum, is already being extracted, with promise of material development. Coal has been successfully mined by foreign concerns for twenty-five years in the western section of Kastamuni, using the port of Songuldak, on the Black Sea, as the principal outlet. That section now produces nearly 1,000,000 tons of bunkering coal annually, and the output there as elsewhere in Anatolia is likely to increase.

The Turkish mining industry undoubtedly is capable of vast development and should become, next to agriculture, the chief mainstay of the country. What is needed is not only outside capital for operating but also railroads to bring in fuel, equipment, and supplies and to carry off the metal produced. For instance, the copper mines of Arghana have yielded as much as 1,500 tons of black copper in a year, although the ore was extracted with hand picks and carried on mule or camel back a many-days' journey to Tokat or Mersina for smelting. Sufficient evidence is at hand to warrant the belief that the provinces of Diarbekr, Trebizond, Erzerum, and Sivas also hold copper deposits of considerable potential value.

Easier of immediate access and operation are the copper, silver-lead, zinc, and manganese deposits of the Kharshut and parallel valleys in the Province of Trebizond, with central outlet at Tireboli on the Black Sea; but even here lack of fuel and communications retards development. French capitalists are displaying activity in this district (Gemush-Khaneh).

Perhaps the most successful mining enterprise in Turkey is the Balia Karaidin lead mine, in the Province of Brusa, which annually produces more than 12,000 tons of argentiferous lead and over 5,000 tons of blende containing 41 per cent of zinc. Other argentiferous or auriferous lead deposits have been located in the Taurus and in the provinces of Kastamuni and Angora. The old Bulgar Maden lead mine, in the Taurus Mountains, back of Mersina, even with present primitive smelting methods, yields a fair percentage of silver and gold.

The meerschaum mines near Eski-Shehr belong to the government and constitute the world's chief supply of this mineral. Before the war they were operated by an Austrian syndicate, and the raw material was manufactured in Vienna. Signal success also has attended the mining in Turkey of chrome, emery, boracite, and salt. Other minerals have been extracted in a more experimental manner, such as deposits of alum (Karahissar, Province of Sivas), manganese (found in nearly all provinces); marble (Province of Brusa); mercury (Ushak, Province of Smyrna); antimony (in the provinces of Smyrna and Brusa); gypsum (provinces of Diarbekr and Van); sulphur (provinces of Smyrna, Konieh, Erzerum, Van, Bitlis); asbestos (Zara, Province of Sivas); arsenic (provinces of Sivas and Van); porcelain clay (Kutaia, Province of Brusa).

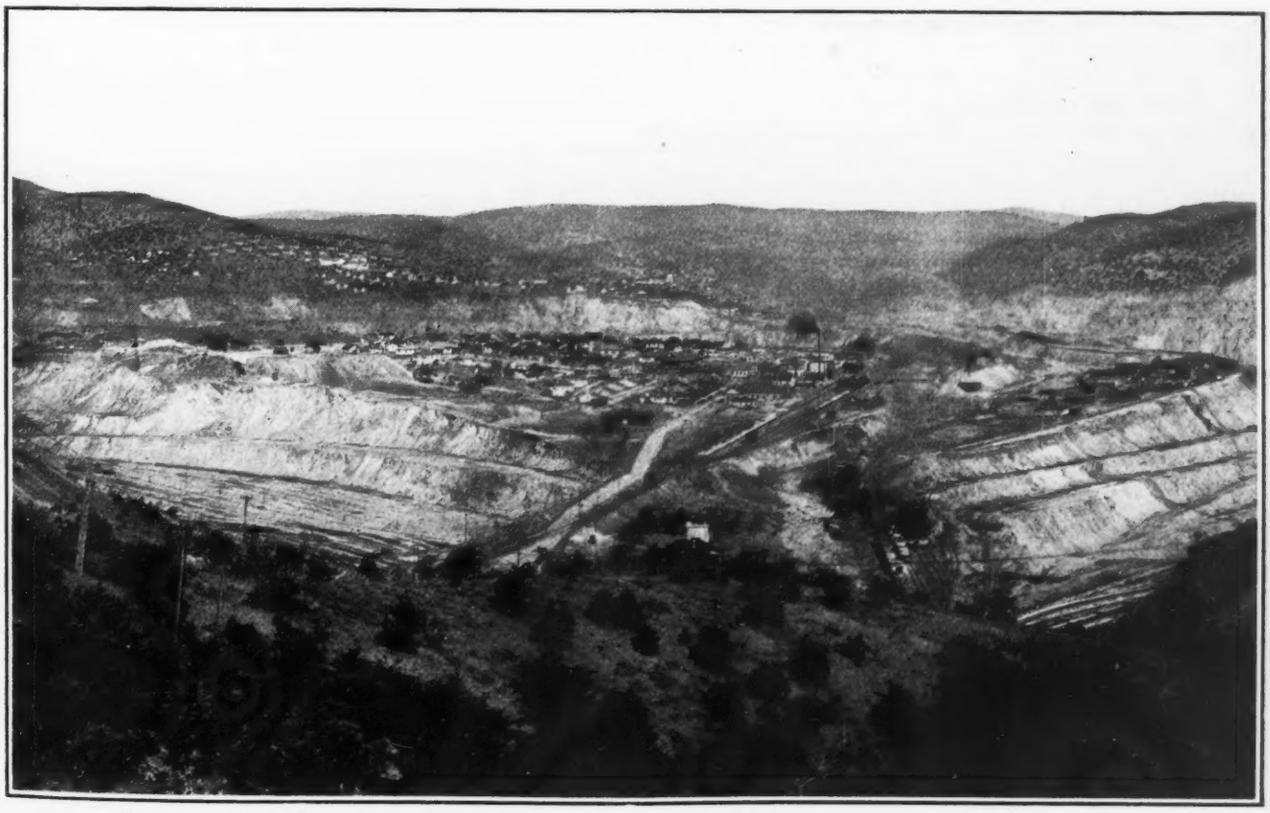
The following statistics show the normal output of the Turkish mines now in operation:

Product	Amount of Production
Antimony ore, metric tons	1,500
Asphalt, metric tons	7,000
Bituminous coal, metric tons	730,000
Boracite, metric tons	16,000
Chrome ore, metric tons	15,000
Copper, metric tons	1,500
Emery ore, metric tons	15,000
Gold, kilos	45
Iron pyrite, metric tons	20,000
Lead, metric tons	13,000
Lignite, metric tons	30,000
Manganese ore, metric tons	12,000
Meerschaum, metric tons	250
Mercury, flasks	4,500
Silver, kilos	250
Zinc ore, metric tons	2,000

The Turkish mining law (1906) appears to work well.

Recent Views of the Chino Copper Co. Operations

The mine—Where 100,000,000 tons of 1½ per cent copper ore has been developed



The town of Santa Rita, N. M., and a portion of the mine

William Kelly, President of the A.I.M.E.

As seen by F. W. McNair

F. W. McNAIR
President Michigan College of Mines

FROM every quarter today comes an insistent demand that the engineer of the future shall be broadly trained, that he shall have breadth of vision concerning industrial operations and the development of new processes, coupled with broad human understanding and sympathy and with those qualities which are essential if he is to lead men.

"Were the forward looking industrialists, practicing engineers, and educators who are voicing this demand intimately acquainted with the membership of the American Institute of Mining and Metallurgical Engineers, and were they to choose a small group from the membership to show as near as possible by present example what they have in mind, William Kelly would be among those chosen.

"Mr. Kelly has the rare ability to make the members of an organization which he manages feel toward him as toward a helpful co-worker rather than a boss. And co-worker he really is, ready at all times to entertain a subordinate's suggestions, and to arrive at the plan of action by agreement rather than dictation, but without shrinking from the responsibility of decision and direction in those cases where agreement is difficult or impossible.

"Mr. Kelly's public service comes as naturally as his technical and operating accomplishments. His ability and his consciousness of obligation to render civic service have been abundantly recognized in consequence of which he has served on many boards and commissions in town, county, and state. Discrimination is difficult, but perhaps his most far-reaching service is that in connection with the Michigan College of Mines, of whose governing board he has been a member for twenty-seven years and chairman for twenty years. He takes a deep and active interest in this institution and many are familiar with his influence on its general conduct, on the broadening of its teaching, and on the standards it maintains. In recognition of his advanced thinking about the education of engineers, the Institute has made him one of its two councilors to the Board of Investigation and Co-ordination created by the Society for the Promotion of Engineering Education.

"Mr. Kelly is a fitting choice for President. I look to see the Institute go forward during this year of his leadership."

As he Appears to Charles F. Rand

CHARLES F. RAND
Mine Owner, New York City

WILLIAM KELLY is one of the most distinguished iron mining engineers in America. He has long been regarded as the dean of the profession in the Lake Superior district and his name is well known throughout our country among men who dig holes in the ground.

"He has had a varied experience and comes to the Presidency of the American Institute of Mining and Metallurgical Engineers full of vigor and with ripened judgment based on many years of contact with the great interests involved and a knowledge of the aspirations of many trained men for whom he has been father confessor.

"After completing his education at Yale and at the Columbia School of Mines and a preliminary trip to Europe, he was successively connected with the Chemical Copper Co., the Kemble Coal & Iron Co., and the Glamorgan Iron Co. in Pennsylvania, and in 1889 he went to the Penn Iron Mining Co. at Vulcan, Michigan, where he has managed these and other great iron ore properties for more than twenty-five years until their sale to other interests. He resides at Iron Mountain, Michigan.

"Mr. Kelly has been a member of A. I. M. E. since 1890, and a director for several years. He is also a member of the Institution of Mining and Metallurgy, of London, the Mining & Metallurgical Society of America, as well as the Lake Superior Mining Institute which he has served as President.

"He has filled many local offices, such as president of his town school board and chairman of the county road commissioners, and vice-president of his bank, and he has been chairman of the Board of Control of the Michigan College of Mines for twenty years. In 1916 he was a delegate to the Republican National Convention. He is one of the most prominent citizens of Northern Michigan.

"Mr. Kelly has traveled much abroad and in 1921 was a member of the delegation of American engineers who presented the John Fritz Gold Medal to Sir Robert Hadfield in London, and to Charles Prosper Eugene Schneider in Paris. While in London, his attainments were recognized and he was made an Honorary Member of the Institution of Mining Engineers. He has contributed many technical papers to the Transactions of the Institute.

"He receives his office of President with the compliment of a unanimous election."

A. I. M. E. Meets in New York

Mining, Milling, and Smelting Topics Crowd Program—Joint Sessions With Economic Geologists and M. M. S. A.

STAFF REPORT

ONCE AGAIN members of the American Institute of Mining and Metallurgical Engineers gathered in New York, on Feb. 18, 19 and 20, for the annual winter meeting in the Engineering Societies Building in West 39th St. The attendance was on a par with that of former years with the usual sprinkling of ladies that serves to enliven these occasions. Handling of the rather full program was facilitated by the prompt starting of the various sessions.

The small lecture room was crowded for the metallurgical section meetings held on Monday and Tuesday afternoons. The first paper offered was entitled "Direct Electrolysis of Black-copper Anodes of High Nickel-Lead Content," by M. H. Merriss, metallurgical engineer of the Nichols Copper Co., Laurel Hill, N. Y.; it was read, in part, by the author. In the course of the paper Mr. Merriss spoke of the effect of polarization which would cause the voltage to build up from 0.4 to 1.8 if the tank were not attended to. This was caused by the accumulation of slime on the anode, which was periodically removed by tapping the lugs of the anodes with a small hammer. In the discussion, C. S. Witherell stated his opinion that the effect noted was caused by increased ohmic resistance resulting from the accumulation of colloidal slime or to the production of sulphates. The cure, he said, was to run a more dilute solution, say of 1.22 sp. gr., or increase the temperature, 145 deg. being suggested as appropriate.

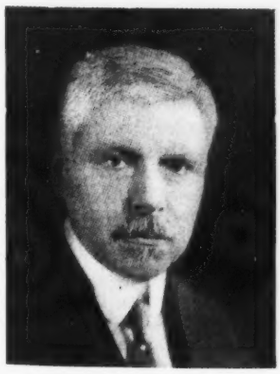
C. P. Linville also spoke of the importance of dilute solutions to prevent trouble from increased ohmic resistance. In his experiments he had found a temperature of 150 deg. satisfactory; the slime cake would build up in a few days. G. E. Dalbey also contributed to the discussion. In his reply to the comments offered, Mr. Merriss said that temperatures higher than 135 deg. had not been tried, and that he did not know whether it would have been an economic procedure to remove sufficient copper to bring the solution down to the dilution suggested.

Engineering Societies Building, New York, where the meeting was held

The second paper, "Calculating the Zinc for Desilverizing Lead Bullion by the Parkes Process" was briefly abstracted by the author, George G. Griswold, and aroused much discussion, in which a strong difference of opinion between Mr. Griswold and C. S. Witherell was manifested. Mr. Witherell offered a written discussion which had been mimeographed and distributed to the audience, in which he explained the process of zinking and expressed the opinion that Mr. Griswold "has written but little that clarifies the subject." In his rebuttal, Mr. Griswold said that Mr. Witherell's objections to his formula might be theoretically right but that the formula worked nevertheless, which was the important thing. Then came up the question of the range of silver content for which the formula was adapted, which, according to the author, was from 20 to 38 oz., cold assay. Mr. Witherell said that 55 or 60 oz. was common and represented good work, a statement that the author of the paper would not concede, expressing the opinion that anything over 40 oz. was poor practice.

H. H. Alexander had had some data prepared on the subject, as a result of inquiries among five or six different lead refineries, a curve being offered to show average practice. Frank M. Smith, speaking for Mr. Beasley of the Bunker Hill smelter, said that he thought formulas could be eliminated if it could be ascertained how much silver the zinc would take up from bullions of different degrees of richness. Mr. Alexander said that in his opinion a definite amount of zinc would take out about so much silver from any grade of bullion and that the pressing out of the lead was the controlling factor. Mr. Linville offered the comment that the amount of zinc used per ounce of silver was about the same at all plants where over 150 oz. of silver was present in the bullion. A further inquiry was made as to what specifications thoroughly softened bullion should meet. To this Mr. Griswold suggested that the antimony content should not be over 0.06 per cent, and the arsenic content less than 0.01. All in all, the discussion, when printed, promises to throw considerable additional light on this subject.

The third item of the agenda was an excellent and complete paper on "The Reduction and Refining of Tin in the United States," specifically at the Perth Amboy plant of the American Smelting & Refining Co., by H. H. Alexander, manager of the Perth Amboy plant, and J. R. Stack, superintendent of the tin department. The paper was read in abstract form by Mr. Stack. In the discussion, E. F. Kern asked if low silica slags had been tried, 30 to 32 per cent SiO_2. Mr. Stack said yes, but much better results were had with 36 or 37 per cent SiO_2. R. L. Hallett of the National Lead Co., then discussed the economics of tin smelting in this country and showed how there was little chance that this industry could be continued, lower smelting costs obtaining in England, though, metallurgically, equally as good work had been done on this side of the water.



Lawrence Addicks

Arthur L. Walker

Professor C. R. Hayward, of Massachusetts Tech., then spoke of the advisability of cleaning tin concentrates before smelting, and of the very high volatilization of tin that could be obtained in a chloridizing atmosphere. In Germany, a process of completely volatilizing tin has been worked out which has promise of commercial application. Dr. Kern told of experiments at Columbia in which tin oxide was reduced with ordinary city gas; as a solid reducing agent, anthracite had proved suitable. Mr. Stack said that he had experimented with volatilization and gaseous reduction too, but that this would involve a smelting of the residue. Dr. Kern doubted if this would be necessary, as substantially complete extraction could be effected on clean concentrates, so that the residue might be thrown away. Mr. Hallett thought the question of the amount of tin left in the residue would be a critical consideration in a reduction process. He then described the process used at the Williams Harvey plant in Brooklyn briefly, showing that it was a practical duplication of the method of smelting used in England, and that from a metallurgical standpoint the plant, now closed down, was a great success. W. H. Bassett, of the American Brass Co., spoke briefly of the requirements for a pure tin for alloy purposes.

Tests on Tin Concentrates Described

R. C. Canby spoke briefly of tin smelting experiments that he had been interested in, and H. G. S. Anderson described the results of some test work on about 10 tons of Bolivian concentrate which had been shipped down to New Mexico for trial in the furnace which he had developed for the production of sponge iron at Chino. Coal that had been partly distilled, down to about 10 per cent volatile matter, was mixed with the concentrate, and the mixture heated in a small 3-ft. experimental mechanically rabbled muffle furnace, the combustion chamber by which the furnace was heated being enclosed in carborundum tubes. The reduction gases from the coal contained about 85 per cent CO and 15 per cent CO_2. The iron present in the concentrate alloyed with the tin forming a "hardhead," but no trouble was experienced in extracting most of the liquid tin from the furnace and a purity of 99.75 per cent was obtained.

A fourth paper "Present Trend in Treatment of Oxidized Ores," by G. L. Oldright, of the U. S. Bureau of Mines, was read by title, it not being adapted to abstraction. The information therein contained will be of interest to all metallurgists who are interested in what has so far been done towards the recovery of all the metals in lead-zinc-silver-copper ores. Discussion was postponed to give an opportunity for all to hear the address on "The Trend in the Science of Metals," by Zay Jeffries, of the Aluminum Castings Co. On Tuesday afternoon, when Mr. Oldright's paper was again read by title, by O. C. Ralston, time again proved insufficient for discussion.

William E. Greenawalt, of Denver, prepared an unusually complete paper on his electrolytic copper extraction process but could not be present to address the meeting, and was therefore unable to answer questions that were raised in the discussion. E. P. Mathewson spoke in very favorable terms of the process, which, it seemed to him, was simple and effective and likely to be a winner. Dr. C. G. Fink and Dr. E. F. Kern brought up two or three points which they considered open to question in Mr. Greenawalt's paper; one being the statement regarding the use of carbon anodes, at the bottom of page 37. H. A. Tobelmann offered a written discussion in which he described the Ajo practice, comparing it with that in the proposed process. He pointed out that the present work at Ajo is considerably better than is indicated by the figures given by Mr. Greenawalt for previous years. O. C. Ralston discussed various points brought out in the paper in the light of work that had been carried out by the U. S. Bureau of Mines. He pointed out the ease of the simultaneous oxidation of ferrous sulphate and sulphur dioxide with air, which he termed an induced reaction. Referring to the Greenawalt statement on page 15 "As surface contact between gas and solution plays so important a rôle in the reduction of ferric salts, it is natural to resort to a device that will create the maximum surface per unit of bulk of solution treated," he mentioned that this was contrary to the conclusions reached in his experience.

E. P. Mathewson
Retiring President of the A.I.M.E.

Galen H. Clevenger

And on page 32, he was inclined to question the statement regarding the ampere efficiency, which was over 100 per cent. This, Mr. Ralston thought, was attributable to the chemical deposition of cuprous chloride in the cathode.

"Ammonia Leaching of Calumet & Hecla Tailings" was read in abstract form by the author, C. H. Benedict, metallurgist of the C. & H., but time did not permit discussion.

Oliver C. Ralston commented briefly on his printed paper, "Hydrometallurgy of Lead," written discussion of which was offered by several metallurgists. The opinion seemed to be that Mr. Ralston's paper was couched in somewhat too optimistic a tone. The recovery of lead by hydrometallurgical methods is yet far from being a commercial success. Poor silver recovery seems to be the worst problem. The use of an acidified brine has been found often ineffective, and a strongly oxidizing rather than a highly acid solution is now preferred, though there are several difficulties. It was the opinion of G. D. Van Arsdale, expressed in his written discussion, that the hydrometallurgy of lead would be likely to advance much more rapidly than had that of copper, for now many of the principles and modes of operation could be borrowed from copper and zinc practice. Electrolytic precipitation he thought offered more than precipitation by sponge iron.

"Electrolytic Zinc from Complex Ores," by U. C. Tainton and L. T. Leyson, was one of the most important papers presented at the entire meeting, containing the summary of the results of several years' work. Mr. Tainton dwelt briefly on the high points of his paper but lack of time prevented oral discussion.

Haultain-Dyer Movies Again Shown

The milling session held on Wednesday morning had more commodious quarters than were provided for the metallurgists but the attendance was no better. Professor H. E. T. Haultain, of the University of Toronto, presented his interesting series of moving picture films showing the action of balls in a ball mill and chunks of rock being crushed in rolls. The A.I.M.E. has been presented with a set of the films, and they may be borrowed for presentation in other parts of the country. Professor Haultain had prepared no paper to accompany the films but explained briefly the work.

A paper on the "Efficiency of Screening" was read in part by the author, Professor Robert K. Warner, of Yale, written discussion being presented by R. C. Canby in which he asked a few questions concerning minor points of the paper, which were subsequently answered. Professor C. E. Locke also gave an abstract of further written discussion that is understood to have been prepared by W. O. Borcherdt.

The only other paper presented was one by A. W. Fahrenwald, "Surface Reactions in Flotation." This very complete discussion of the theory of flotation is the result of the author's work at Moscow, Idaho, during the last three years. A brief discussion was given by Professor Arthur F. Taggart, who took up one or two minor points.

Petroleum Program Lengthy

An ambitious program arranged for the symposium on petroleum and gas drew a liberal attendance. In all there were four sessions, morning and afternoon on Monday and Tuesday, E. De Golyer occupying the chair. Mr. De Golyer, who is vice-president and general manager of the Amerada Petroleum Corporation, as well as retiring chairman of the Petroleum Section of the Institute, reviewed the oil situation in 1923. He predicted a large decrease in production and an increase in the prices of crude and its derivatives. Production in 1924 would not equal consumption, he asserted, unless new pools were discovered. The world's output reached a billion barrels in 1923 for the first time, an increaase of 18.6 per cent over 1922. The extraordinary output of the United States, which was 178,459,000 bbl. over 1922, was responsible. Production from the three flush fields of the Los Angeles basin alone, he said, was greater than the increase in the world output. Every bonanza pool in the country had passed its peak, he said, and production would soon fall below consumption if more than one additional pool were not rapidly developed. No such additional pool was in sight, he said. Developments during 1923 in various sections of the country furnished themes for other papers. E. G. Gaylord and L. C. Decius discussed California; C. A. Fisher, the Rocky Mountain states; J. M. Sands, Kansas; J. H. Gardner, Oklahoma; F. J. Fohs, East Central Texas; E. T. Dumble and W. F. Bowman, Gulf Coast; M. E. Wilson, Northern Louisiana and Southern Arkansas; and J. H. Hance, Illinois.

Arthur Knapp spoke on the relation of price to the law of supply and demand. Joseph Pogue's subject was "The Trend of Prices in the Petroleum Industry." In the discussion that followed, the chairman expressed the opinion that the large number of flush pools that are responsible for the present situation were an accidental occurrence and not due to a superior technique in drilling. H. G. Schneider of the Amerada company, presented a valuable paper on the Smackover field. A paper on the Powell field, in Texas, that was to have been written by Messrs. DeWolf and Whitehead, disappointingly failed to materialize. Other papers were on the program, including one on preparing composite decline curves of oil and gas wells from trade journal data, by R. H. Johnson and C. L. Shirley, and another on distributing profit and risk between oil land owner and producer by Mr. Johnson alone.

Valentin R. Garfias, of Henry L. Doherty & Co., talked on developments in Mexico. In the following discussion he said his company was shooting six wells at once, bringing forth the humorous comment from the chair that he was evidently trying to develop an independent system of fissures and fractures. Another speaker remarked that he had shot a large number of wells in Mexico with nitroglycerine, preparing the "soup" on the ground, with no results. One well remained dry, he said, although near a 40,000-bbl. well. In response to a query as to what size diamond drill holes the company was using, Mr. Garfias replied "the largest that could be drilled from a 10-in. casing." W. S. Livingston, Jr., thought that with large holes there might be a sharp deflection.

Representatives from eastern oil districts were prominent at the morning session on Tuesday. Papers on developments in Kentucky and Tennessee (by Wilbur A. Nelson); the northern and southern Appalachian fields (by G. H. Ashley and D. B. Reger, respectively); and on the Trenton limestone of northwestern Ohio (by J. A. Bownocker) were read, the last by the chairman. Discussion bore chiefly on the papers of Dr. Ashley and Dr. Nelson. The latter said that he had been loath to say that in his territory they had been getting oil from Cambrian rocks, but he presented evidence to show that it must come from below the base of the Ordovician. No fossils had been found in the wells under discussion, he said. Dr. Ashley said that there seemed to be a good chance of finding oil in the Knox dolomite, coming between the Ordovician and the Cambrian. The outlook for 1924 in Pennsylvania, Dr. Ashley said, was for the continuance of existing conditions. He told briefly what was being done to rejuvenate the Bradford pool by means of water recovery. Prof. R. E. Somers spoke on recent deep drilling in the Appalachian field. Developments

Members Registered from Outside the Metropolitan District

Archer, R. S., Cleveland, O.
Arms, R. W., Chicago, Ill.
Atchinson, E. R. Jr., Tullaham, Tenn.
Baldwin, R. L., Milwaukee, Wis.
Baudy, M. C., Redfield, Iowa.
Barker, S. Jr., Butte, Mont.
Barksdale, R. H., Richmond, Va.
Bell, J. G., Canton, O.
Benedict, C. H., Lake Linden, Mich.
Black, Mrs. H., Galveston, Tex.
Bohner, Carl M., Altoona, Pa.
Boylston, H. M., Cleveland, O.
Bright, G., Pittsburgh, Pa.
Brinker, A. C., El Paso, Texas.
Brooke, J. K., Portland, Ore.
Bumbaugh, F. T., Bethlehem, Pa.
Burchard, E. F., Washington, D. C.
Campion, E. W., Columbus, O.
Carmichael, N., Arizona.
Carpenter, J. A., Los Angeles.
Clayton, C. Y., Rolla, Mo.
Clevenger, G., Brookline, Mass.
Coe, H. S. J., Lawrence, Kan.
Comstock, E. H., Minneapolis, Minn.
Comstock, G. F., Niagara Falls.
Corse, W. M., Washington, D. C.
Cusac, W. R., Detroit, Mich.
duRell, T., Washington, D. C.
Dunyon, A. F., Salt Lake City.
Elliott, G. K., Cincinnati, O.
Estabrook, E. L., Casper, Wyo.
Fairchild, D. E. Jr., Phila., Pa.
Fettke, C. R., Pittsburgh, Pa.
Fieldner, A. C., Pittsburgh Pa.
Finkeldey, W. H., Palmerton, Pa.
Foley, F. B., Rolla, Mo.
Day, E. B., Phila., Pa.
Demorest, D. J., Columbus, O.
Denis, T. C., Quebec, Canada.
Dickerman, N., San Francisco.
Dimmick, R. B., Canton, Ohio.
Dix, E. H. Jr., Pittsburgh, Pa.
Franchot, R., Washington, D. C.
Freeman, J. R., Jr., Wash., D. C.
Fulton, C. H., Rolla, Mo.
Gibbs, G. W., Pittsburgh, Pa.
Gibson, R., Boulder, Colo.
Goodale, S. L., Pittsburgh, Pa.
Grant, W. M., Birmingham, Ala.
Greenidge, S. M., Wash., D. C.
Greensfelder, N. S., Wilmington.
Greve, L. W., Cleveland, O.
Griffis, R. O., Ashland, Ky.
Gross, J., Boston, Mass.
Guess, Mrs. G. A., Toronto, Can.
Hall, A. E., Palmerton, Pa.
Handy, J. O., Pittsburgh, Pa.
Hardy, J. G., Boston, Mass.
Haultain, H. E. T., Toronto, Can.
Hawkridge, L. D., Boston, Mass.
Hayward, C. R., Cambridge.
Head, J. L., Chuquicamata, Chile, S. A.
Holbrook, E. A., State College, Pa.
Holden, E. C., Baltimore, Md.
Hornor, R. R., Clarksburg, W.Va.
Houser, J. N., Knoxville, Tenn.
Hsi, T. C., Shanghai, China.
Hull, D. R., Toronto, Ont., Can.
Hurter, C. S., Wilmington, Del.
Jeffries, Zay, Cleveland, O.
Jorgensen, F. P., Gillespie, Ill.
Joseph, F. L., Minneapolis, Minn.
Jurden, W., Anaconda, Mont.
Katz, F. J., Washington, D. C.
Kelly, S. F., Toronto, Canada.
Kelly, W., Iron Mountain, Mich.
Kichline, F. O., Lebanon, Pa.
Kingdon, F. H., Claremont, N. H.
Knapp, A., Philadelphia, Pa.
Knight, R. H., Boston, Mass.
Krivobek, Vsevolod N., Cambridge, Mass.
LaFallette, H. M., LaFallette, Tenn.
Lake, M. C., Duluth, Minn.
Lawson, A., Berkeley, Cal.
Lawson, F. R., Troy, N. Y.
Leonard, W. H., Denver, Colo.
Lind, S. C., Washington, D. C.
Lindberg, C. O., Los Angeles, Cal.
Lingle, C. M., Uniontown, Pa.
Little, J. E., Bethlehem, Pa.
Locke, A., San Francisco, Cal.
Locke, C. E., Boston, Mass.
Loo, W. W., Yunnanfee, China.
Lundberg, Sven, Stockholm, Sweden.
Lyon, D. A., Washington, D. C.
McAdam Jr., D. J., Annapolis, Md.
McCourt, W. E., St. Louis, Mo.
McFarland, D. F., State College, Pa.
McNair, F. W., Houghton, Mich.
Macnutt, C. H., Montreal, Can.
Marvin, T., Wilmington, Del.
Mason, S. L., Pittsburgh, Pa.
Merrill, C. W., San Fran., Cal.
Merrill, M. W., Woodbridge, Nova Scotia.
Miller, B. L., Bethlehem, Pa.
Miller, J. C., Lexington, Ky.
Miller, L. B., Cleveland, O.
Mitchell, C. B., 2nd, Bethlehem, Pa.
Mitke, C. A., Bisbee, Ariz.
Mitton, H. E., Codnor Derby, Eng.
Moore, E. S., Toronto, Ont., Can.
Morris, E. L., Bellefonte, Pa.
Morris, H. T., Bethlehem, Pa.
Morrison, G. A., Keene, N. H.
Mosonyi, E., Mexico City, Mex.
Moyer, W. I., Pittsburgh, Pa.
Muir, N. M., Muskogee, Oklo.
Murray, C. B., Cleveland, O.
Nead, J. H., Middletown, O.
Nelson, W. A., Nashville, Tenn.
Newton, C. E., Corvallis, Ore.
Norris, R. V., Wilkes-Barre, Pa.
Okada, K., Tokyo, Japan.
Olson, L. W., Mansfield, O.
Packard, S. A., Oklahoma City, Okla.
Paige, S., Washington, D. C.
Pallister, H. D., Tuscaloosa, Ala.
Palmer, W. S., Reno, Nev.
Parker, R. A., Denver, Colo.
Patch, N. K. B., Buffalo, N. Y.
Paul, J. W., Pittsburgh, Pa.
Pearman, J. E., Sweetwater, Tenn.
Perrott, G. S., Pittsburgh, Pa.
Perry, V. D, Berkeley, Cal.
Pond, W. E., Rolla, Mo.
Porter, J. B., Montreal, Canada.
Priestley, W. J., Pittsburgh, Pa.
Ralston, C. C., Berkeley, Cal.
Ramage, J. H., Bloomfield, N. J.
Rawdon, H. S., Wash., D. C.
Read, T. T., Duluth, Minn.
Reger, D. B., Morgantown, W. Va.
Reybold, E. C., Denver, Colo.
Rice, G. S., Washington, D. C.
Rice, L. V., Chicago, Ill.
Roberts, K., Chicago, Ill.
Roberts, M., Seattle, Wash.
Rockwood, N. C., Chicago, Ill.
Rogers, A. H., Brookline, Mass.
Roush, G. A., Bethlehem, Pa.
Ryan, J. T., Pittsburgh, Pa.
Saklatwalla, B. S., Pittsburgh, Pa.
Sauveur, A., Cambridge, Mass.
Schmid, M. H., Canton, O.
Scott, H., Washington, D. C.
Scott, W. R. K., Gary, Ind.
Sevenughaus, N., Phoenix, Ariz.
Shaner, E. L., Cleveland, O.
Singewald, J. T. Jr., Baltimore, Md.
Smith, O. A., Bellevue, Pa.
Smith, C. R., Allentown, Pa.
Smith, F. M., Spokane, Wash.
Smith, L. E., Cleveland, O.
Somers, R. E., Pittsburgh, Pa.
Spencer, A. C., Wash., D. C.
Sperr, F. W., Houghton, Mich.
Stoughton, B., Bethlehem, Pa.
Stolfus, M., New Hampton, Ia.
Strobel, R. L., Helena, Mont.
Sundt, O. F., Christiania, Norway
Sweetser, R. H., Columbus, O.
Sykes, W. P., Cleveland, O.
Tainton, A. C., Kellogg, Ida.
Tait, G. M. S., Wash., D. C.
Taylor, D. A., Pittsburgh, Pa.
Thompson, W. J., Phila., Pa.
Turner, S., Toronto, Ont., Can.
Van Evera, J. W., Crosby, Minn.
Van Winkle, C. T., Salt Lake City, Utah.
Wade, W. R., Edwards, N. Y.
Waterhouse, G. B., Cambridge, Mass.
Wheeler, H. A., St. Louis, Mo.
Williams, C. E., Seattle, Wash.
Williams, H. M., Dayton, O.
Williams, P. S., Ramsey, Mich.
Wolf, F. L., Mansfield, O.
Wood, F. W., Baltimore, Md.
Woodward, C. V., Anaconda, Mont.
Wright, W. J., Bear River, N. S.
Wyer, S. S., Columbus, O.
Yardley, J. L. McK., Pittsburgh, Pa.
Zapffe, C., Brainerd, Minn.

outside of the producing oil states were briefly reviewed by K. C. Heald. The afternoon session was devoted to hearing papers on developments in South American countries and elsewhere abroad.

Mining Methods Discussed

Unfortunately the writers of many of the papers presented at the two meetings of the Section on Mining Methods were unable to be present, so that in some cases interesting questions raised by the audience could not be answered authoritatively. Nevertheless, the discussion was keen and many interesting features were brought to light. Norman Carmichael, formerly general manager for the Arizona Copper Co., read a paper of which he and John Kiddie, mine superintendent, were joint authors, describing the development of the extensive underground and surface railway system in the Clifton-Morenci district. The track gage is only 20 in., 30-car trains of 10-ton cars being hauled distances averaging over two miles at low cost. The feature is the narrow gage of the tracks which necessitates the use of triple-head electric locomotives. Allen H. Rogers raised the question whether gable-bottom side-dump cars would be used if the equipment were to be redesigned. Mr. Carmichael thought not—that a revolving tipple would be substituted. The use of trolley locomotives was determined upon before the storage battery locomotive was thoroughly developed and the question of the respective merits of the modern equipment would have to be considered in a new installation.

D. R. Thomas showed lantern slides in connection with Thomas C. Baker's article that appeared in the *Engineering & Mining Journal-Press* on glory-hole mining at Fresnillo. In answer to questions as to the reason steam shoveling methods were not used in mining this large deposit of 3 oz. silver ore, he declared that the necessity for importing shovel operators from the United States was probably the deciding factor in deciding on the glory-hole method. R. M. Raymond emphasized the fact that the whole project was an example of extremely careful planning and efficient fulfillment of the plans. C. A. Mitke said that the costs were even lower than had been calculated. E. Perkins drew attention to the use of double shoots 4 ft. 2¼ in. wide instead of a single 6 ft. shoot. Mr. Thomas said that the single shoot was originally planned and did not know the reason for the change. He explained the high cost of development ($17.30 per foot) by saying that much of the work was done before adequate power was available. A paper on mining methods in the Telluride district of Colorado, by Charles N. Bell, was read by title only.

Allen H. Rogers presented P. R. Bradley's contribution on operations at the Alaska-Juneau mine, where gold ore averaging 96c. per ton is being milled. Mr. Rogers emphasized the fact that ordinary methods of sampling were of little value except when interpreted in the light of long experience at the mine. The average of a great many grab samples is depended upon rather than upon systematic channel sampling.

Two papers describing operations of the Kennecott Copper Corporation at its different mines in Alaska were discussed by Alan M. Bateman, who illustrated his unusually interesting remarks by some excellent slides. He told of mining large blocks of 70 per cent copper ore, parts of which were pure chalcocite. An interesting point was the operation of the Glacier mine, in which the country rock is ice and the run-of-mine ore contains 50 per cent ice. He said that freezing weather in the mine was the best shift boss ever developed. A. L. Walker read a paper on the method used by the Iron Cap Copper Co. at Globe, Ariz., written by Charles E. Lees, in which a system of "Inclined Cut-and-Fill" mining is used. Little timber is required and stope floors inclined at 34 deg. eliminate most of the shoveling. H. G. Moulton read the paper prepared by S. J. Kidder, general manager of the Mogollon Mines Co., describing mining operations at Mogollon, and C. A. Bohn presented a paper entitled "Sampling and Estimation of Cordilleran Silver-Lead-Limestone Replacement Deposits," by Basil Prescott.

B. Britton Gottsberger

Industrial Relations Topic at Three Sessions

Safety of the worker was the feature of two of the three sessions held under the direction of the Committee on Industrial Relations. At the third, social reasons for industrial unrest were discussed. In the absence of Robert Linton, the chairman, Sidney Rolle, R. Dawson Hall and Arthur Notman presided in turn. B. F. Tillson found some support for his contention that immigrants from southern European countries made good laborers; in addition, he pointed out, they were willing to work while others were not. E. A. Holbrook, who talked on education in safety matters, and Arthur Notman presented papers; a paper by R. R. Sayers on physical and mental factors in industry was read at the first session. W. W. Adams told of the plans of the Bureau of Mines to standardize reports regarding mine accidents so as to make the statistics more valuable. R. L. Sanford, of the Bureau of Standards, reported progress in experiments to devise a method for detecting unsafe conditions in hoisting rope by means of the magnetic reluctivity relationships. T. T. Read read general papers by himself and H. Foster Bain. N. S. Greensfelder suggested the desirability of further investigation of the possibility of the premature firing of electric exploders in mines by means of stray radio currents.

Interesting comparisons between labor conditions in Australia, Connecticut, and other parts of the United States occupied most of the third session. A. J. Lanza, who has been visiting in Australia, and D. L. Stirling, Secretary of the Australasian Institute of Mining and Metallurgy, gave the Australian viewpoint. A paper by Robert E. Talley, of the United Verde Copper Mining Co., and one by L. J. Sillcox, of the Chicago, Milwaukee & St. Paul Railway were read by Arthur Notman and Sidney Rolle respectively. The discussion brought out food for thought for everyone.

Taxation Conference Wants Proposed Law Clarified

The upshot of the Taxation Conference was the passage of a resolution recommending that the president of the Institute immediately appoint a committee to protest against certain objectionable portions of the proposed new tax legislation. It was generally agreed that Section 204, which deals with the basis for determining gain or loss, depletion and depreciation, is entirely too involved and too complex to be interpreted even by "experts." The present law is not ideal but it is far better in the opinion of the conference, than the proposed measure. The retroactive features of the new bill are particularly objectionable. Among those who condemned the bill were R. V. Norris, H. B. Fernald, and Paul Armitage who presided at the meeting.

Opportunities for Mining Engineers

An unusually stimulating session was the joint meeting with the Mining and Metallurgical Society of America in which broader phases of the engineering profession were considered. John Wellington Finch discussed opportunities for engineers in foreign countries, referring especially to the Near East. The importance of finance in the engineer's work was discussed by Lucius W. Mayer. R. Dawson Hall, Editor of *Coal Age*, pointed out the opportunity for the metal mining engineer in assisting in the solution of problems in the coal mining industry. A paper of somewhat similar character by Nathan C. Rockwood, Editor of *Rock Products*, dealt with the relations of the engineer to the exploitation of non-metallic mineral deposits.

The Annual Dinner

The amenities were observed as usual at the Waldorf on the evening of the last day. At the banquet the James Douglas Medal was presented to Charles W. Merrill in recognition of his accomplishments in the field of non-ferrous metallurgy. After the inaugural ceremonies for the incoming

president most of the diners adjourned to the grand ball room to finish the occasion.

Officers for 1924 Announced at Annual Business Meeting

The annual business session held on Tuesday morning was attended by about fifty members including representatives of several of the local sections. Following the reading of the minutes of the 1923 meeting, President E. P. Mathewson gave a brief report of the activities during his administration. Secretary Sharpless called attention to his printed report as presented to the directors, this also including reports from membership and library committees.

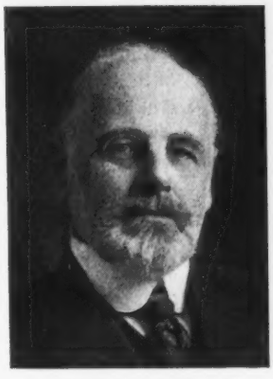
Announcement of officers for 1924 was made, the report of the tellers being as follows: President, William Kelly; vice-presidents, E. L. De Golyer and Charles W. Merrill; directors, R. V. Norris, George Otis Smith, P. B. Butler, L. D. Ricketts and Bertram D. Quarrie.

H. A. Wheeler, representing the St. Louis session, suggested fewer directorate meetings as a means of securing great co-operation among the membership. He also stated that the withdrawal of the A.I.M.E. from the Federated American Engineering Societies was deplored by the membership in the St. Louis section. Col. A. S. Dwight outlined the part the Institute had played in the activities of the Federated and pointed out the fact that action on the part of the Institute directorate to withdraw had been prompted by lack of funds. R. A. Parker, of Denver, and Jay A. Carpenter, of Los Angeles, spoke briefly on behalf of their sections.

Society of Economic Geologists Meets Jointly With A.I.M.E.

The joint meeting of the Society of Economic Geologists with the American Institute of Mining and Metallurgical Engineers occupied a prominent place in the Institute program. One of the main features was symposium of papers on secondary enrichment, largely the result of the investigations conducted under Professor L. C. Graton, of Harvard, which were financed by leading copper companies. At the meeting held Tuesday afternoon, Prof. Graton described the organization and operations of the Secondary Enrichment Investigation. This was followed by a paper by Edward H. Perry, Augustus Locke, and L. C. Graton, on Rock Alteration associated with Copper Sulphide Deposition in Igneous and Schistose rocks. This was followed by a very interesting paper by Geoffrey Gilbert on Oxidation and Enrichment at Ducktown, Tenn. Mr. Gilbert showed that the process of production of rich secondary copper sulphides at Ducktown, involved a first alteration of the abundant primary pyrrhotite of the ores, to marcasite, then the replacement of the marcasite by chalcocite and other copper sulphides.

Besides the two sessions on secondary enrichment, two other sessions were held. Tuesday morning Dr. George F. Kunz talked briefly on a collection of elements to be installed at the American Museum of Natural History in New York. He reported that excellent specimens of a large number of rare elements had been secured through various sources, and that the collection bid fair to become a most remarkable one. Dr. Kunz's talk was followed by three papers which were the outcome of the recent protracted lawsuits at Bingham, Utah, between the Utah Apex and Utah Consolidated mines. They consisted of a paper on Petrographic Studies of Limestone Alterations at Bingham, by Prof. A. N. Winchell, of the University of Wisconsin, Madison, Wis.; a paper on the Limestone Ores of Bingham, Utah, by Richard N. Hunt,



James F. Kemp

mining geologist, Los Angeles, Calif., and a paper on the Geological Features and Court Decisions of the Bingham District, by Orrin P. Peterson, consulting geologist, Brookline, Mass. None of the authors were able to present their papers personally, the first two being given in abstract by the chairman of the meeting, Prof. J. F. Kemp, and the last being outlined by Professor Waldemar Lindgren.

Prof. Winchell's paper showed that in the Bingham district there is a complete gradation between sandstone and limestone, while shales are absent. The development of lime silicates in the rocks, however, was not a result of combination of the lime and silica in the original rocks; but they were due to the introduction of extraneous silica. There was no important change of volume, the loss of carbon dioxide being balanced by the accession of silica and in some cases magnesia. Mineralization and silification took place after the silication, and at considerably lower temperature; while carbonation occurred at still lower temperatures, and was probably due to surface rather than magmatic waters.

Mr. Hunt's paper showed that the geographic distribution of the ores shows them to be in some way related to the monzonite intrusion. It also points out the clear application of the Zonal Theory of Spurr in the Bingham district where copper ores occur near the monzonite, and lead ores further away.

Most of the ores have originated by replacement: but it may be that some of the heavier sulphide material has been injected as veindikes, in accordance with the conception of Spurr. The copper ores, moreover, are largely confined to areas where the dark limestone has been bleached white by the igneous effects; while the lead ores are usually in the dark limestone. Most of the ores occur within about 1,000 or 2,000 feet of the larger porphyry intrusions.

Mr. Peterson's paper gave a clear idea of the general geological conditions at Bingham, the relation of the ores to favorable formation like the younger limestone. The points on which the litigation was based was clearly set forth by Mr. Lindgren in his summary. One vein, carrying lead ore, was shown to cut the copper ores, which is in harmony with the conditions shown in other districts, and indicates falling temperature during the process of ore deposition, with the cooling of the igneous mass.

In the afternoon session, which as above noted was largely devoted to Secondary Enrichment papers, Dr. Charles R. Fettke, of Pittsburgh, read a paper on the Magnetite deposits of Porto Rico. This paper was descriptive, and bore also on the genesis of the ores. They have been formed by replacement. The iron minerals are magnetite and hematite, with lime silicates predominant in the gangue. Hence Dr. Fettke concluded that the deposits belong to "the contact-metamorphic type," a conclusion evidently open to discussion and disagreement. Other papers were read and discussed.

On Wednesday, both sessions were devoted to the Secondary Enrichment subjects. A paper on Copper Deposits in the Nikolai Greenstones, Kuskulana-Kotsina District, Alaska, by Alfred Wandke, was presented in the absence of the author, by Mr. M. N. Short. A paper on Primary Downward Changes in Ore Deposits by Prof. W. H. Emmons was read by title in his absence. A paper on Habit, Etch Structure and Geological Significance of Chalcocite by Alfred Wandke, was presented by proxy. Augustus Locke presented a paper by himself, D. A. Hall, and M. N. Short which was on the subject of the Rôle of Secondary Enrichment in Genesis of Butte Chalcocite. There followed a general discussion on the subject of Secondary Enrichment.

The problem of primary chalcocite in the Butte mines came in for a great deal of comment. Chalcocite, acocrding to Mr. Reno Sales has been found as deep as 3,600 feet below the surface, in this district. It was the contention of the investigators of the Secondary Enrichment investigation that much if not most of this deep chalcocite is primary, or "hypogene," while one or two geologists took a more cautious attitude. The graphic intergrowths of minerals, set forth as an evidence of contemporaneity by Mr. Locke, were held by Prof. Lindgren to result from the replacement of one of the minerals by the other. Professor A. C. Lawson questioned the whole assumption of the crystallization of the veins from solutions confined to the fissures in which the veins are now found, suggesting the operation of diffusion in rocks charged with ground-water. He was not seconded in this view by any one present.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary of the Week

SIX mine shafts at Butte, Mont., will be deepened to 3,500 ft. by the Anaconda Copper Mining Co. The project, involving the expenditure of $400,000, is a step in the program to mine the many veins in the lower portion of the Butte ore deposits.

The Chipman Chemical Engineering Co. has commenced the production of arsenious oxide at its new plant on San Francisco Bay.

An output of 45,000 tons of lead and 4,500,000 oz. of silver has been reached by the Burma Corporation at its Bawdwin mines.

Bullion returns indicate that the United Comstock Mining Co. failed to earn operating expenses at Virginia City, Nev., during the fourth quarter of the year. Mill heads averaged $3.651.

Production of hydrated lime has been commenced by the Chief Consolidated Mining Co. in the Tintic district, Utah.

About 625,000 lb. monthly will be added to the Michigan copper output by the completion of the Tamarack tailing-treatment plant.

The Utah Copper Co. shipped 48,000 tons of ore from its Bingham mine during one day, recently. This is probably a world's record for ore production.

Increases in appropriations for the Bureau of Mines and the Geological Survey have been made by the Senate Committee on Appropriations.

The American Smelting & Refining Co. will enlarge the capacity of its smelter at Tacoma, Wash., to provide for increased foreign shipments.

Negotiations are believed to be completed whereby the Federal M. & S. Co. will absorb the Childress-Moses interests in the Tri-State zinc-lead district.

Operations have been resumed on a leasing basis at the Atolia tungsten mine near Randsburg, Calif., after several years shutdown.

Atolia Tungsten Mine Reopened for Leasing Operations

Company Mills Ore and Divides Profits Equally with Lessee—"Journal-Press" Quotations Govern

The Atolia Mining Co. which successfully mined tungsten at Atolia near Randsburg, Calif., but has had its mine closed down for several years during the period of low prices for tungsten ore, has reopened its mine and is now leasing certain portions to miners. The leases are being granted on a 50-50 basis to miners who may want to prospect and work outlying sections of the property. The company will take the ore, concentrate it and market the product, half of the proceeds to be paid to the lessee. In addition supplies and tools are furnished the lessees at cost and necessary equipment and machinery required to develop, mine and hoist the ore are rented to them under reasonable terms, representing little or no profit to the company.

Payment by the company is to be made on the basis of one-half of 90 per cent of the average quoted market value for 60 per cent tungstic acid, domestic sheelite ore, f.o.b. Pittsburgh, Pa., the quotations to be taken from the *Engineering & Mining Journal-Press* for the week ending 30 days after the date of the preliminary sampling at Atolia. Payment for ores less than 60 per cent tungstic acid content is on the basis of a sliding scale, 75 per cent on content for ores 2 per cent tungstic acid or less; 80 per cent on 10 to 20 per cent tungstic acid content; 85 per cent on 20 to 30 per cent tungstic acid content; 95 per cent on 50 to 60 per cent tungstic acid content and 100 per cent on ores containing 60 per cent or over in tungstic acid.

New Record Shipment for Utah Copper Co.

When 48,000 tons of ore left the Utah Copper Co.'s steam-shovel pit at Bingham, Utah, one day recently, a new record for the company was established. Probably no mine of any kind ever shipped as much ore in a single day. Shipments averaged 45,000 tons per day during the week ended Feb. 9.

Gold Production in the Belgian Congo Increased 36 Per Cent

According to official Belgian statistics just published at Brussels, the gold production in the Congo State in 1923 amounted to 3,146 kg. as against 2,311 during 1922, an increase of 36.5 per cent. The operators are of the opinion that the production during 1924 will be raised to at least 3,400 kg.

Four Properties Active in Hilltop District, in Arizona

Hilltop Metals Co. Ships Silver-Lead Ore—King Copper Will Sink—New Veil Gets Machinery

The Hilltop Metals Mining Co., operating at Hilltop, Cochise County, Ariz., has thirty-five miners at work at the mine and has been shipping about 25 tons of ore per day to Rodeo, N. M., the nearest rail point. It is hoped to increase the tonnage to fifty very soon. The ore contains silver and lead. R. O. Fife is general manager.

The King Copper Co., operating five miles east of Hilltop, expects to resume operations within sixty days. All surface machinery has been put in shape and improvements on the road leading to the mine have been made. The company expects to start sinking its shaft from the 300 level to a depth of 500 ft., and crosscut the vein on the 300 and 500 levels. Robert A. Wehr is general manager.

David J. Doran, owner of the sunset group at Sunset, near Paradise, Ariz., reports that he has crosscut the vein and is still in ore. Assays show $40 per ton principally in lead, calculated on a 7½c. market.

The New Veil Mining Co., has started work on its property located about three miles east of Hilltop. A force of men are at work and a compressor and other machinery has been installed.

A. S. & R. Co. Will Increase Capacity of Tacoma Smelter

The Tacoma smelter of the American Smelting & Refining Co., is to be enlarged to take care of increased shipments, according to Francis H. Brownell, vice-president, who has recently visited the plant. Large foreign shipments from various sources including the product of the Kennicott Copper Co. in Alaska and shipments from Peru and Chili in South America are sent to this smelter.

Good Ore on No. 4 Tunnel Level in Betty O'Neal Mine

Important developments are reported from Battle Mountain, Nev., in the Betty O'Neal mine. On the No. 4 tunnel level, a north drift shows 3½ ft. of 85-oz. silver ore, and a raise from this level has opened a narrow streak of high-grade ore. The vein is being stoped over a width of 50 ft. on this level. Mine production is at the rate of 100 tons of ore per day. A crosscut from the 150 level from the shaft, approximately 250 ft. below the No. 4 tunnel level, is now within 40 ft. of the projected position of this big vein and if ore be found in the vein at this elevation a large shoot will be available for development and production. General mine conditions are said to be very good, and 1924 should be a prosperous year for the Betty O'Neal company.

Lessees Operate Rochester Mine by Reason of Strictest Economy

Bullion production by lessees operating the mine of the Rochester Mines Corporation at Rochester, Nev., amounted to about $38,000 for January. Tonnage produced and milled and profit figures are not available as yet. New ore has been opened on the 800 and other levels, some of which is of good grade, so that production is assured for a few months at least. This mine has, for several years, been essentially a low-grade mine, and the lessees have been able to make a success of the undertaking only by practising every economy in operation of both mine and mill since the completion of the Pittman Act silver purchases.

Old Nevada Hills Mining Company Tries the Oil Game

Stockholders in the Nevada Hills Reorganized Mining Co. were advised on Jan. 29 that the company had acquired valuable oil leases in the Kern River and Midway fields, in practically proven territory. The first productive oil sand in these districts is said to be at from 1,100 to 1,200 ft. in depth. Two wells are already started and one well is practically completed. The company owns three standard rigs and plans continuous drilling. The Nevada Hills gold-silver mine is at Fairview, Nev., but has not been operated for several years, owing to its low-grade ores.

Burma Corporation Mines 700 Tons Per Day at Bawdwin

Reaches Annual Output of 45,000 Tons Refined Lead and 4½ Million Ounces Silver—Labor Situation Improved—Ore Reserves Increase—First Dividend Paid

Speaking at the Annual General Meeting of shareholders at Rangoon recently, Sir Trevredyn Wynne, chairman of Burma Corporation, Ltd., declared that the projected plan of mining 700 tons of ore per day with a production of about 45,000 tons of refined lead and 4½ million ounces silver annually, was now an accomplished fact. He declared that he felt confident that the second stage in the program which would involve an output of 1,000 tons of ore daily from the company's mines at Bawdwin should be realized by the end of 1925. Provision is being made for the mining of a larger tonnage and additions to the smelter and railway are in hand.

The proceeds from the sale of products during the year ended Dec. 31, 1922, showed an increase of 22 per cent over 1921, and during the first six months of 1923, proceeds amounted to Rs. 14,043,628, being an increase of about 10 per cent over the rate of 1922. These results are the consequence of increased production, higher metallurgical recovery, and decreased operating costs. The cost per ton of refined lead during the first half of 1923 was Rs. 20 per ton less than in 1921 in spite of the fact that in that year specially selected high-grade ore was mined.

An initial dividend of 4 annas per share, totaling Rs. 3,385,422, was paid last August and another will be proposed soon.

Respecting the labor situation which is a source of much trouble the chairman said: "Here again I am happy to be able to report a very substantial improvement, not only in the numbers in our employ at the mine, but also in the regularity of their attendance at work. The continuous efforts which we have been making, both in China and elsewhere, some of which, as I explained last year, resulted in disappointment at the time, are now beginning to bear fruit, and we have had for some little time past small parties of men coming in from Yunnan and from Northern India on their own account in search of employment at the mine. . . .

"I am inclined to think that the real cause of our success, so far attained, particularly as regards holding a greater proportion of our men at the mine during the wet season, is to be found in the wonderful improvement which has been made in the housing and living conditions, both at Bawdwin and at Tiger Camp. The Yunnanese live well and are well housed in their own country, but I have now no hesitation in saying that our mine settlements with their well-built shops, ample water-supply, medical facilities and good accommodation, in spite of the very restricted areas available for building, bear favorable comparison with the best conditions which any of our labor has hitherto enjoyed.

"Owing to our isolated situation and to climatic conditions, over which we have no control, we are, nevertheless, always likely to be faced with a certain shortage of men during the wet season, but I feel confident that this shortage will steadily be reduced and that we are rapidly overcoming our difficulties in this direction, and are in the fair way to obtain the settled labor force which we require. Our endeavors to recruit suitable men will be continued, for in this way it will be possible for us to restrict our requirements when the 'cold-weather' Chinamen arrive and to select from them only the more experienced and the stronger men, and thereby release ourselves from the annual necessity of flooding the mine with new and totally inexperienced men, with the all-round reduction in efficiency which it entails. Our present policy is to give more attention to the training of our men and the improvement of their individual efficiency, rather than to rely on increasing the numbers to the maximum extent."

Concerning the ore-reserve position the chairman said: "I desire to point out that we commenced the period under review with reserves totaling 4,290,358 tons averaging 23 oz. Ag, 25·1 per cent Pb and 17·5 per cent Zn, and, notwithstanding that we have extracted 290,589 tons, our reserves at July 1 last showed the satisfactory position of 4,511,909 tons, averaging 22·8 oz. Ag, 25·3 per cent Pb and 16·9 per cent Zn, or an increase of 221,551 tons since January 1, 1922, while the grade is practically unaltered, so you will see that without taking into account anything more than 100 ft. below the developed portion of No. 7 Level, we have a long life in front of us well assured. The increase in our reserves is of course due to the development work done on No. 7 Level, which has opened up ore of a slightly better grade than that of our reserves above that level as regards silver and lead with a somewhat reduced zinc content. As the full area of the orebody at this level is not yet exposed, it is too early to give final figures for its metallic content, but I am able to inform you that any loss of revenue consequent upon its decreased zinc content will, to a material extent, be offset by the more economical metallurgy that will result in the recovery of its lead and silver content."

In the Railway Department, great progress has also been made, the tonnage hauled having been increased from 428,000 to 686,000, or an increase of 60 per cent. The experimental work on the production of zinc concentrates, according to the chairman, has made material progress and a good grade concentrate has been produced. Further modifications in the experimental plant have just been made and it is hoped before long to be in a position to increase the tonnage.

Open-cut operations of the United Verde

Jib Mill Construction at Basin, Mont., Progresses

The Jib Consolidated Mining Co. expects to have its concentrator at Basin, Mont., in operation the early part of March. The delay in the completion of the 300-ton plant has been caused by the slow delivery of machinery. The first of two ball mills has arrived and is being installed. An early delivery on the other mill is expected. A force of 75 men is employed at the property. They are divided between mine development, mill construction and installation of mill machinery. The company controls the Hope and Katie mines, from which considerable tonnages of ore have been extracted.

Grass Valley Operations

Local reports credit the Gold Wedge Divide Co. with an ore discovery in the Randolph Flat mine, Grass Valley district, Calif. The mine is being equipped with a compressor and a shaft has been sunk to 100 ft. in depth. H. J. Snyder has bonded the Midas mine and is sinking a shaft from which to explore old workings. The Nicols Ranch has been bonded to L. E. Stin, of San Francisco. The Newtown mine is being equipped and preparations are being made for exploration. M. J. Brock is reopening the Grass Valley Boundary mine. The present small shaft is being enlarged to water level.

Work Progresses in United Verde's Big Open Cut

THE United Verde Copper Co. is operating three steam shovels in its big open cut, one 8-yd. shovel being engaged in handling ore and the other two smaller ones are at work is rapidly uncovering a part Three churn drills are in operation, and the work of constructing a slope that will permit operation of the large shovel at the ore face is progressing rapidly. Ore mined is either transferred through raises to the 1,000-ft. haulage level of the mine or is stocked at one of the large piles near the pit. The work is rapidly uncovering a part of the fire area and the old workings as exposed at the surface present an interesting section of the orebody.

Ray-Chino Merger Approved

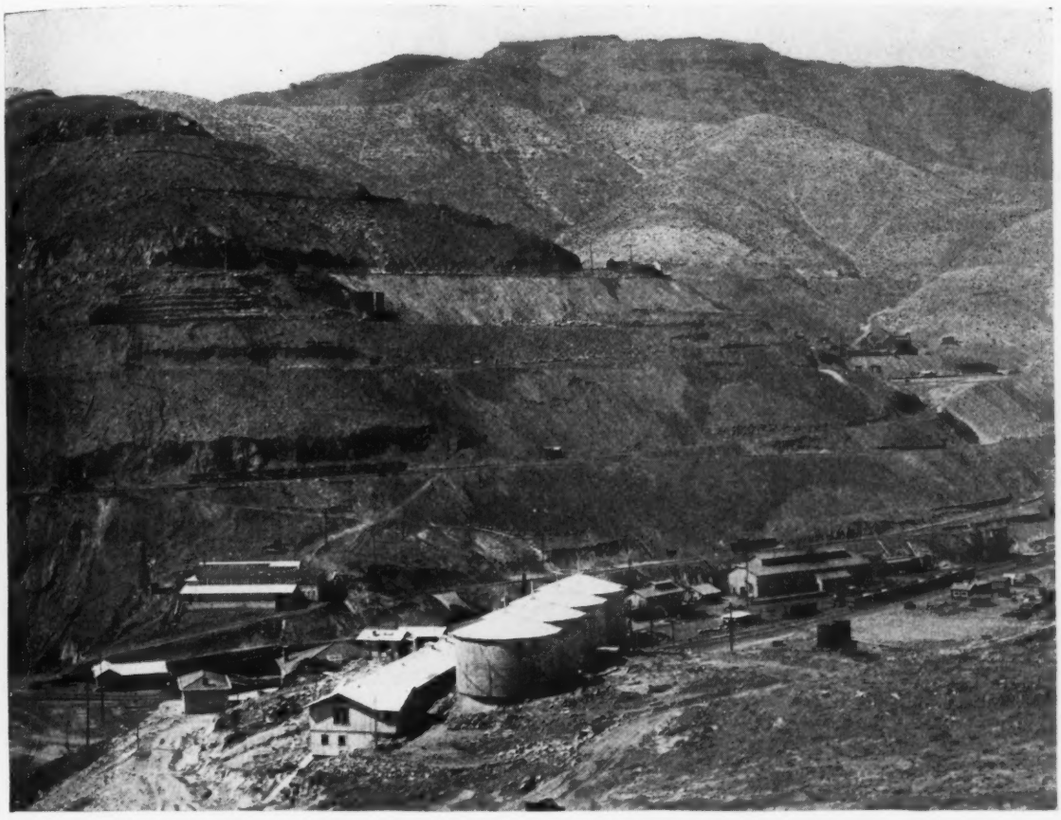
Stockholders of the Ray Consolidated Copper Co. and the Chino Copper Co., on Feb. 15, formally approved the plan of consolidation of the two companies as recommended by the directors in January. The terms provide the exchange of 1⅛ shares of Ray stock for each share of Chino. This ratio was determined by a thorough appraisal by engineers. It reflects approximately the market quotation.

United Comstock Lost on $3.651 Heads During Fourth Quarter

According to the bullion tax statement of the United Comstock Mines Co., operating at Virginia City, Nev., for the last quarter of 1923, the company mined and milled 128,877 tons of ore, of an average value of $3.651 per ton, with a gross value of $470,575.48. Operating costs totaled $478,202.46, so that operating loss for the quarter was $7,626.98. A change in management was made at the middle of last year and results have been improved.

Island Mountain Mine Increases Shipments of Copper-Iron Ore

The Island Mountain mine in the southwestern corner of Trinity County, Calif., has increased its shipments of copper-iron ore to the Tacoma smelter to 1,000 tons per month. The mine is peculiarly situated in that the ore is dumped from the mine cars into bins alongside of the tracks of the Northwestern Railroad and loaded in railroad cars for transportation to San Francisco Bay, 195 miles distant. It is transported to Tacoma by water. The ore contains iron and sulphur and a small although important amount of copper. Gold and silver are also present. The equipment is not extensive and a high mining rate per man employed enables an exceedingly low cost to be obtained.



Copper Co. at its mines at Jerome, Ariz.

Telluride Cyanide Plant at Oatman Nearly Finished

The new cyanide mill, construction of which by the Telluride Mining Co., at Oatman, Ariz., is nearing completion will have a capacity of 60 tons per day. Work is under the supervision of William Linfesty. The design of the plant is similar to that of other mills in the district that have so successfully treated the Oatman ores. This company has previously shipped its higher grade ores to the Tom Reed mill, but the new plant will make it possible to treat lower grade ore that could not be profitably shipped to the custom mill. The Telluride mine is reported to have reserve ore worth $500,000 that can be profitably treated in the new mill.

Experiment Station at Rolla, Mo., Now in Operation

The new experiment station for the Rolla School of Mines, at Rolla, Mo., has been completed and placed in use. It was erected by the state at a cost of $125,000, and the furnishings were jointly provided by the state and federal government. It will serve as a laboratory for students of the mining school, and also as a station for experimentation by the present department of metallurgy of the state and of the U. S. Bureau of Mines. Extensive investigations already are being started on the electrothermic dry distillation of zinc ores.

Federal M. & S. Co. May Purchase Childress-Moses Interests

Latter Control Ten Producing Mines—Transaction Would Be Largest in History of the District

It is announced at Joplin, Mo., that the Federal Mining & Smelting Co. is contemplating the purchase of all the Childress-Moses interests in the Joplin-Miami field. The completion of such a deal would be the largest mining transaction ever recorded in the district. The Childress-Moses interests include the ownership or control of ten mines, all good producers, including the Muncie, Homestake, Lucky Syndicate, Gordon, Lucky Kid, Lucky Bill, Lucky Junction, Whitebird, Silver Fox and Whiskbroom. The acquisition of these mines, or the great part of them, would mean making the Federal M. & S. Co. the largest single producing zinc company in this field. At present it owns and is operating the Brewster, Dobson, and Farmington mines in the Oklahoma field, and the Kansouri in the Kansas field. It is also opening the Jarrett mine in the western part of the Kansas field. These properties have potential production of around 30,000 tons of concentrates yearly, and the Childress-Moses mines have almost as much.

P. W. George is the local manager of the Federal properties, and Frank Childress and A. C. Moses, of Joplin, are in charge of the Childress-Moses properties.

Miami Copper Co. Teaches Spanish to Its Foremen

Regular instruction in Spanish is being provided by the Miami Copper Co. for its foremen and bosses at a series of classes that are being held at the mine department. The course of study provided consists mostly of simple conversational Spanish, particular attention being given mining terms and such phrases as are needed in directing the regular mine operations. Much Mexican labor is now used in the mines of the southwest, the proportion having greatly increased in the past two years and it is believed that a better understanding of the men can be had by the bosses if they have a knowledge of Spanish and that more thorough instruction can be given as regards the job and safety measures. The Miami company is also conducting a series of foremanship training conferences.

Butte & Superior Shipped 3,500 Tons Copper Ore; New Record

During the week ended Feb. 9, Butte & Superior shipped from its Black Rock mine, at Butte, approximately 7,100 tons of zinc ore and 3,500 tons of copper ore to the Washoe smelter of the Anaconda Copper Mining Co. This is a new high record of weekly shipments, the best previous copper record having been 2,700 tons. Development of copper ore is satisfactory.

Chief Consolidated Starts Production of Hydrated Lime

Has Fine Deposit of Highgrade Limestone at Eureka, Utah—New Plant Model of Efficiency

The Chief Consolidated Mining Co., of Eureka, Utah, has begun operations at its new plant at Homanville, built to produce hydrated lime. In its limestone quarries at that place, the Chief is said to have the largest deposit of highgrade material in the United States. All arrangements have been completed to make rapid and economical production possible. The limestone from which the hydrated lime is produced is broken at the quarries by drilling and blasting, care being taken not to reduce the material too far. Teams are now used to carry the broken limestone to the hydrating plant about 200 yards distant. Later an aerial tramway will be installed. The storage bins which receive the limestone are so built that the material can be fed directly into the kiln, where it is burnt so as to dissociate the carbon dioxide, and leave the exceptionally pure calcium oxide. The limestone is burned by indirect fire, only the flame coming into contact with it, and the carbon dioxide is drawn off by electric fans placed at the top of the circular kiln. The limestone is left in the kiln about 48 hr., when it is drawn off, and laid on the cooling floor. The product is carefully sorted to eliminate any waste or imperfectly burned pieces. The burned limestone is then taken to a Sturtevant crusher, and pulverized to a maximum of ¼ in., and from there elevated to a steel storage tank of 40-ton capacity. A 10-in. steel scroll conveyor at the bottom of the tank takes limestone from the tank, and discharges it into an elevator, which carries it to the third floor of the hydrating plant. After complete hydration, the steaming white moist mass is passed from the bottom of the hydrator into a steel hoppered tank of two-ton capacity, to which is attached a 20-in. patent Raymond feeder, which feeds the mass into a cylindrical cooler, 25 ft. long, and 6 ft. in diameter, equipped with feeding arms throughout its entire length. These arms keep the hydrate in continual motion, aiding the driving off of the excess moisture and heat, and discharging the material when thoroughly dry into a Raymond pulverizing mill, where it is crushed to a 200 mesh, and the coarse particles rejected.

The plant has been constructed so that its capacity may be increased at minimum expense. Foundations are laid for two additional kilns, so that in a short time its capacity will be increased from 30 to 60 tons of hydrated lime. A ready market is expected in the building trades, milling plants, insecticide plants, tanneries, and sugar manufactories, and as a disinfectant, fertilizer, plaster and for miscellaneous domestic purposes. The plant is concrete and steel throughout, covered with galvanized iron. All equipment is electrical, and there are no belts and shafts. Utmost care has been taken to provide safety devices, such as the installing of steel railings, and the placing of housings over all motors and machines.

Old Klondiker Gets Gold Placer Concession in Siberia

A placer gold mining concession in the Amur district in Siberia, operated by James Vint, of Seattle, Wash., under an agreement with the old Far East Republic, has been ratified by the Federal Council of Commissars at Moscow, according to a message to the *New York American* dated Feb. 14. Vint, who is an old Klondiker, is the first American to secure a Far East Russian Concession from the Commissars.

Three Properties of Bingham Mines Co., Earned Profit in 1923

The Bingham Mines Co., operating the Eagle and Blue Bell, Victoria, and American Star mines at Eureka, Utah, and the Dalton & Lark, Yosemite, and Commercial mines at Bingham, Utah, has filed its statement with the state board of equalization, showing the earnings and losses incurred during 1923, in accordance with the Utah law for taxation purposes. Utah mines pay taxes on surface holdings, and equipment, etc., and on the value of three times the net proceeds for the year. Three properties of this company show net proceeds for 1923. The net proceeds for the Eagle & Blue Bell mine during 1923 having amounted to $66,434 as compared with $122,441 in 1922 for the Victoria, to $295,515 as compared with $207,231 in 1922: and for the Dalton & Lark $86,365 as compared with $19,470.

The company's American Star in Juab County, the Yosemite, and the Commercial mines at Bingham all showed deficits. The American Star, $12,300; the Yosemite, $7,380; and the Commercial, $1,900.

Banks in New Mexican Mining Region Embarrassed by Cattle Men

On Feb. 4 three banks in Silver City and one in Tyrone, N. M., closed their doors, leaving Grant County without banking facilities of any sort. Two of the banks closed were national banks. The cause of this unfortunate condition is said to be the prolonged depressed condition of the cattle industry. In the southwest, cattle loans have always been considered as good banking collateral, while encouragement to the mining industry has been looked upon askance.

Which means most to the industry and business of the territory served by the closed banks is significantly shown by the following compilation of monthly payrolls made by the *Silver City Enterprise:*

Chino Copper Co	$205,000
Mogollon Mining Co	25,000
Phelps Dodge Corp (now shut down)	15,000
Hanover-Bessemer I. & C. Co.	10,000
Empire Zinc Co	25,000
Black Hawk Mining Co	5,000
Grant County Mining Co. and others	5,000
	$290,000

New Arsenic Plant Starts Production Near San Francisco

Chipman Chemical Co. Uses McDougall Roaster—Gets Customs Ore From California and Nevada

The Chipman Chemical Engineering Co. started its new arsenic reduction works at Martinez on San Francisco Bay, on Feb. 4. The company produces refined white arsenic from ores shipped from various points in California and Nevada.

The new plant comprises crushing equipment, a seven-hearth McDougall roaster, and arsenic kitchens. Additional roasters may be installed. The ore is shipped in by rail at present and the cars are unloaded directly into storage bins from which it passes to crushers and rolls. The roaster is oil-fired with automatic temperature control; the fumes pass into a dust chamber and thence into the kitchens. These have been arranged so that they can be cleared during operation, thus making it unnecessary to shut down the plant for the purpose of removing the arsenic.

The plant was designed by Ralph N. Chipman, president of the company, and Charles R. Wraith, of the Anaconda Copper Mining Co., and has been erected under Mr. Chipman's personal supervision. For the present the plan is to keep the plant running on custom ore.

The Chipman Chemical Engineering Co. is a large user of arsenic for the manufacture of insecticides, weed killer and cattle dip.

The new plant at Martinez is situated on the Southern Pacific Railroad and has water facilities comprising a dock extending into the bay at which vessels drawing 26 ft. may be unloaded. Its first year's operation is expected to supply about 3,000 tons and this capacity will, it is understood, be increased when mines recently acquired by the Chipman company get into full production.

Through a subsidiary, the Arsenic Products & Refining Co., the Chipman company has begun development work at the recently acquired White Iron mine at Madera, Col., and it is expected that shipments of ore will be made soon. The ore goes direct to the new arsenic plant at Martinez. The ore from this mine is a high-grade mispickel and it is believed that the deposits are extensive. Other mining properties are in process of development.

The Chipman company is the producer of calcium arsenate, paris green, lead arsenate, cattle dip and chemical weed killer. It maintains factories at Bound Brook, N. J.; Houston, Texas; and Martinez, Calif.

Current Ore Shipments from Lordsburg, N. M.

The total ore shipments from the Lordsburg, N. M., mining district for the month of January were 9,671 tons. The bulk of these ores were supplied by the Eighty-five mine of the Calumet & Arizona Mining Co. The Bonney mine shipped 334 tons. Of this three carloads containing 171 tons netted $5,569.87. These ores are all siliceous copper, carrying gold and silver and are very much in demand at the smelters at this time.

London Letter

By W. A. Doman
Special Correspondent

"Houses" Plan to Stimulate Interest in Mining Shares

Public Will Be Offered Gold, Silver, Tin and Lead Issues—Kaffirs Prominent —South Lorrain Boomed

London, Jan. 31—If, for a considerable time, little interest has been manifested by the public in mining and mining shares, it would appear that the neglect is in a fair way to be remedied. There would even seem to be rivalry from various quarters for the support of the investor. Whether it be in regard to base metals, or to gold and silver in Canada, or gold in South Africa, signs are not wanting that markets are to be invigorated. Many companies are angling for additional capital, and if it cannot be obtained by one method, another will be tried. To put the matter in a different way, "houses" with wares to sell expect soon to see the public "on the feed." The supply of metals is none too plentiful, and as regards tin, lead and zinc it is believed that present prices will be improved upon. One of the features of the position is the manner in which low priced —not necessarily cheap—Kaffirs are being brought into prominence. East Rand Proprietary shares are always favorite gambling counters when the market shows signs of life, and, of course, they are "bought from the Cape." It is remembered that a commission was appointed by the Union Government to investigate the possibilities of an amalgamation or working agreement with the Cinderella Consolidated; this commission has not yet reported.

Robinson Deep Not Popular

The new issue of Robinson Deep "B" shares, to which I referred last week, has not met with a very favorable reception. Holders of the original shares agree that new capital shortens the space between them and dividends, but they fail to see how any benefit arises when the profits that rightly belong to them are to be divided among the holders of another 100,000 shares. They knew they would have to wait and they prefer to wait.

If one may judge by the literature now being issued here, Canadian mines are to be active contributors to the world's stock of precious metals this year. South Lorrain is being especially "boomed." Hamilton, Erlich & Co. are taking a very prominent part. They control various properties, including the Huronian Belt, and E. T. McCarthy has written a report that is judged distinctly hopeful. The executors of the estate of the late Sir S. Neumann—a Rand magnate—are inquiring into matters, and generally British capital for the British Empire is being advocated.

The Russian Soviet Government is still endeavoring to get recognition by Great Britain, and it is believed that the Socialists now in power here will grant it, but the latter do not find the position the simple matter they originally thought it to be. There are many complications. The Lena Goldfields which has passed out of the control of the Consolidated Gold Fields, is negotiating a separate arrangement. Matters are said to have proceeded so far that only the signature of a Russian official is now required. This position has been reached by the company waiving all claims against the Russian authorities. Other mining companies could regain possession of their properties on similar terms, but so far the directors have not favored this policy. In any case it is satisfactory to learn that Russia has altered its views in regard to capitalism.

News from Washington

By PAUL WOOTON
Special Correspondent

Senate Committee Increases Appropriations for "Bureau" and "Survey"

Wants Studies of Electrical Machinery in Mines—Topographic and Geologic Surveys Have Great Public Value, Explains G. O. Smith

Increases in the appropriations for the Bureau of Mines and for the Geological Survey were recommended by the Senate Appropriations Committee in reporting out the Interior Department appropriation bill. The total carried in this measure as it goes to the Senate is $1,900,468 for the Bureau of Mines and $1,747,193 for the Geological Survey.

The increase made by the Senate in the Bureau of Mines appropriation is to provide for studies in connection with the use of electrical machinery in mines. This is a phase of mining development on which little work has been done by the Bureau because of the lack of specific appropriation for the purpose. The economies that can be effected by the use of alternating current have resulted in the increased use of electrical machinery in mines, Director Bain, of the Bureau, told the Appropriations Committee.

In the face of the national need for the completion of the topographic map of the United States, the Appropriations Committee of the House reduced that item from $540,711, approved by the Director of the Budget, to $500,000. This cut was eliminated promptly by the Senate committee. In explaining the importance of topographical surveys to all types of engineering, George O. Smith, director of the Geological Survey, made the following statement:

"Insistent demand for topographic surveys comes from all of the various lines of engineering activity which have to do with industrial, transportational, and agricultural development. Topographic maps have many uses. They serve as a base on which most problems affecting human activities may be studied and investigated and plans made for their solution. The lack of topographic maps in any area retards the development of that area and increases the expense of planning public works. The possession of such maps insures the economic planning of improvements and reveals possibilities for the development of resources that otherwise would remain unknown.

"The following are a few of the specific activities in which topographic maps are essential: Water-power development; flood control; irrigation; drainage; highway construction; railroad location; oil development; mining operations; forestry work; soil surveys; geologic investigations; land classification and valuation; city planning; military maneuvers."

Veto House Action

The House committee also cut the budget recommendation for geologic surveys. These cuts were not made, it is believed, with the idea of effecting economies but with the idea of registering disapproval of the effort made by state geologists and others to secure larger appropriations for topographical and geologic surveys. Despite the fact that Geological Survey officials had been careful to participate in no way in that effort, one of the members of the House Appropriations Committee was so obsessed with the idea that this movement had been encouraged by them that he is thought to have taken this method of chastising them. The Senate committee was prompt in restoring the items to the budget figures. The need for geological surveys was set forth by Director Smith, as follows:

"Geology is one of the natural sciences, and geologic work has its application to almost all lines of industry. Useful minerals and rocks are parts of the rocky shell of the earth; i. e., they are geologic phenomena. To know where and how to search for the metals, the mineral fuels, and building stones requires understanding of geologic principles. The mining industry constantly and urgently demands aid of the Geological Survey and by its studies the survey establishes the laws of occurrence of these minerals. It indicates where they are, and, what is almost equally valuable, where it is not worth while to search for them.

"The work in applied geology includes the work on the precious and nonferrous metals, gold, silver, copper, lead, and zinc, on ores of iron and steel alloy metals, such as manganese and molybdenum, on the fuels, oil, gas, and coal, and on the fertilizer minerals, phosphate, potash, and the nitrates, and on numerous less important mineral substances. The metalliferous work receives about 30 per cent of the total appropriation."

R. H. Stewart Takes Over Ruth-Hope Property at Sandon, B. C.

R. H. Stewart, formerly general manager for the Consolidated Mining & Smelting Co., and Vancouver associates have formed a company to take over and operate the Ruth-Hope mine, at Sandon, B. C. The company has an authorized capital of $1,000,000. The Ruth, which adjoins the Silversmith, was among the first mines to be worked in the Slocan. During the early operations it produced 17,410 tons of culled ore, averaging 85 oz. of silver and 1,300 lb. of lead per ton, and paid its owners $165,000 in dividends. A fault was then encountered, and, as the vein could not be relocated, the mine was closed and remained closed until the spring of 1922, when it was turned over to lessees, who relocated the vein and mined some good ore. In the fall of 1922, Mr. Stewart and his associates took an option on the property, and during last year shipped 741 tons of silver-lead ore, which is said to have given a return of $38,000. Besides the lead ore the mine contains a good deal of silver-zinc ore, which up to now has not been utilized. It is understood that a mill will be erected on the property this year.

Centralize Government Alloy Investigation

The field office of the Bureau of Mines at Ithaca, N. Y., has been closed. In the future, the alloy work that has been conducted at that office under the direction of H. W. Gillett will be pursued in Washington under a co-operative agreement with the Bureau of Standards. Dr. Gillett recently accepted the appointment as chief metallurgist of the Bureau of Standards to succeed G. K. Burgess who now is director of the Bureau of Standards.

E. L. Mack has been assigned by the Bureau of Mines to work with Dr. Gillett, so that the Bureau of Mines may have full advantage of all work done on alloys, and so that the work of the two Bureaus on this subject may be conducted without duplication.

No Early Increase in Dome Mill Capacity

No increase in mill capacity is to be expected at the Dome property in northern Ontario in the near future. It was reported that the mill would be increased to 1,700 tons a day, but there is nothing in this story. The company is experimenting with rolls in the mill, but no decision has been arrived at regarding their use. Mill heads are running at about $9 a ton, and the mill is treating about 1,250 tons a day. The company has taken an option on a group of claims in Destor Township, Northwestern Quebec, at a price of $150,000, for an interest of 80 per cent, with the first payment in August of this year. The claims are covered with heavy overburden and will be diamond drilled.

Pinto Valley Company Gets New Properties Near Miami, Ariz.

Garret Mott, of New York City, president of the Pinto Valley Co., has announced plans that are under way by which his company will acquire the Arizona National Copper, Cactus Copper and the Castle Dome holdings, all of which are in the vicinity of Pinto Creek, near Miami, Ariz. The proposed merger will mean the grouping together of a number of promising porphyry properties lying west of Miami for effective development.

The Pinto company was organized in 1922 and acquired deeds to a number of claims that were formerly owned by the Cactus and Arizona National companies. The present plan of merging has been approved by the directors of each company and will be submitted to the stockholders immediately. T. R. Drummond, of Globe, will be in active charge of the development program, if the reorganization is effected.

The Pinto company recently completed a roadway from the Miami-Superior highway, and some development work has been in progress at the Cactus mine for several months. The combined holdings of the companies total 102 claims.

Old Dominion Mine in Washington Optioned by Hercules

Owners of the Hercules mine in the Coeur d'Alene district, in Idaho, recently obtained an option on the Dominion Silver Lead Mining Co.'s property known as the Old Dominion mine 7 miles East of Colville, Wash. The deal involves about $250,000. The Dominion company is capitalized for 600,000 shares, par value 50c., with 330,000 shares in the treasury. A recent strike on the 600 level of the mine is responsible for sale.

Those taking the option are Harry L. Day, Jerome Day, Mrs. Eleanor Boyce, F. M. Rothrock, August Paulsen, L. W. Hutton, and the Markwell interests.

W. L. Linney, a former manager of the Nipissing mine in Cobalt, Ont., is the present manager for the Dominion Silver Lead company and was responsible for the development of the property to the present stage.

The Old Dominion mine was discovered in 1886 and was one of the first producers in Washington Territory and is reported as yielding ore to a net value of $1,000,000.

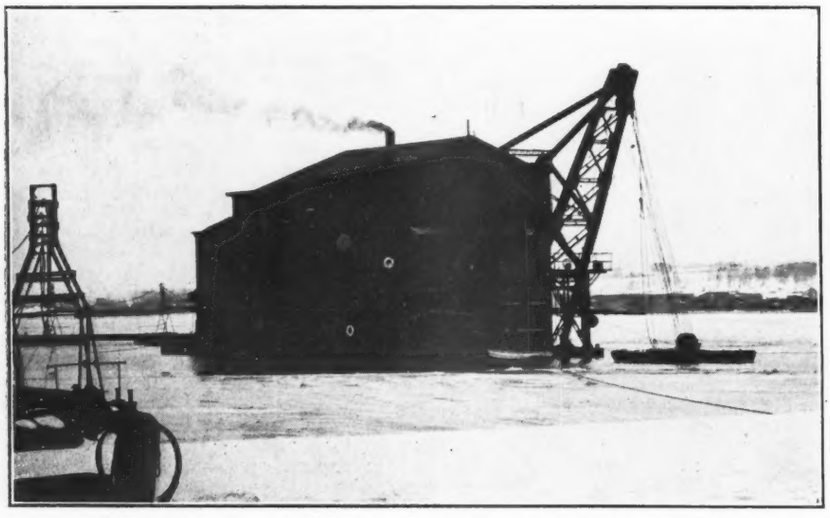
Plenty of Power for Northern Ontario Mining Districts

Officials of the Northern Canada Power Co. state that the Quinze plant, which is located 125 miles from Porcupine, Ontario, will be delivering power in June. The capacity of this plant is 20,000 hp., and with this additional amount available there will be no further danger of the recurring power shortages, which have, in the past, greatly retarded the development of the camp. The immediate power outlook is good, and due to the exceptionally favorable winter, no shortage is expected this season. The company is in a position to supply considerably more power than is now being used from its present plants.

Tamarack Tailing Treatment Will Make 625,000 Lb. Copper Monthly

Completion of the "reclamation" plant on the conglomerate waste sandpile at the Tamarack stamp mill on Torch Lake, which, it is expected, will go into commission May 1, will add approximately 625,000 lb. to the monthly refined copper output of Calumet & Hecla Consolidated, in the Michigan copper district. The plant is less than half the capacity of the one which has been in operation on the Calumet & Hecla tailings deposit since 1915. The first step is the recovery of the sand by means of a dredge similar to the one shown in the accompanying illustration.

The Tamarack sandpile contains 12,500,000 tons of tailings, of which it is estimated 10,000,000 tons can be dredged out of the lake and treated. The sand contains 12 lb. of copper per ton, of which between 9 and 10 lb. can be recovered. Operated at capacity it will take twelve to thirteen years to exhaust the deposit. Copper will be recovered at a cost of about 6c. per lb., exclusive of smelting and selling.



Dredge for reclaiming copper tailing from the old C. & H. mills in Michigan. A similar dredge will be used for "mining" the Tamarack sand

Societies, Addresses, and Reports

Illinois Geological Survey Studies Road Materials

Its Policy Shaped to Include Investigation of Fundamental Problems to End of Conserving Natural Resources

When the $60,000,000 road bond issue was passed in Illinois, the question of securing adequate and suitable materials from which to build roads most economically was important. With this need in view, the Illinois State Geological Survey, situated at Urbana, Ill., made a reconnaissance survey of the gravel and limestone deposits of the state to determine the location of desirable pits and quarries easily accessible to the railroads. The amount of overburden necessary to be removed and the quantity of gravel or rock available were taken into account in selecting favorable sites.

The locations of the sand and gravel deposits of Illinois bear a close relationship to certain features of glacial geology. There are two general types of existing sand and gravel pits: the first, outwash deposits on the outer slopes, south or west, of terminal moraines, and, second, valley train deposits along valleys leading out from terminal moraines. Field work now in progress indicates that new deposits are to be found in just such situations with reference to the terminal moraines referred to.

The total production of sand and gravel in 1922 was 8,840,293 tons, valued at $5,411,821, representing an increase over the previous year of approximately 36 and 10 per cent in quantity and value, respectively.

The most important limestone formations of the state are found in the older geologic formations, mostly in the Silurian and Mississippian systems, although some limestone is also obtained from the Ordovician, Devonian, and Pennsylvanian. The formations in Illinois have been altered from their original horizontal position, and now form a broad spoon-shaped shallow basin in such fashion that the older thicker limestone comes to the surface along the southern, western, and northern margins of the state. The great dearth of commercially workable deposits of limestone over the interior two-thirds of the state is due partly to the fact that that portion is so heavily covered with drift that limestone which otherwise might be quarried is not accessible, and partly to the fact that the Pennsylvanian strata which underlie the drift over the broad central basin consist mainly of sandstones and shales. Because limestone road materials used in central Illinois must necessarily be shipped in from the borders of the state, special emphasis was laid during the study on possible shipping sites. If the law proposing the $100,000,000 road bond issue passed by the Legislature is ratified by a referendum vote of the people at the general election in November, 1924, the information now in hand will be of increasing importance.

In 1921 the total production of limestone was 4,256,580 tons, valued at $4,298,402, of which almost one-half represented the quantity used for cement, much of which is used for road making.

The policies of the Illinois Geological Survey have been broadly shaped to include the investigation of all fundamental problems in the geology of Illinois, the topographic mapping of the state, and the application of the results of such geologic and topographic work to the development and conservation of the resources of the state. Besides investigations of supplies of highway materials in Illinois, there are also involved studies in oil, coal, clays of many grades, cement materials, sand and gravel for concrete use, glass sand, molding sand, metalliferous deposits, fluorite deposits, glacial studies in reference to engineering projects, artesian water supplies, reclamation of overflow lands, and other problems which come up from time to time in connection with the activities of the various industries in the state.

The Survey maintains a bureau of information in response to the many and varied requests for data regarding the mineral resources of the state from teachers, students, commercial concerns, private individuals, municipalities and engineers. F. W. DeWolf, Chief of the Illinois Geological Survey for the last fourteen years, resigned recently to become the chief geologist for the Humphreys oil interests in Texas, and Morris M. Leighton, formerly of the University of Illinois, has been appointed his successor.

Mine-Rescue Meet to Be Held in Globe March 4-5

The Globe-Miami District Mine Rescue and First Aid Association will hold the fourth regular mine rescue maneuver on March 4 and 5, at Globe, Ariz. These maneuvers will be held in an isolated section of the surface workings of the Old Dominion mine. The sixty-man rescue crew, station equipment and personnel will be used to work out problems in mine rescue and fire-fighting under as nearly actual conditions as possible. Byron O. Picard, district engineer, and Frank C. Gregory, mining engineer of the U. S. Bureau of Mines at Berkeley, also B. F. McDonald, of the Bullard Co., Los Angeles, and A. E. Miller, safety engineer of the Moctezuma Copper Co. at Nacozari, Mexico, will be among those present.

Williams Explains Council's Reorganization

The organization of the American Engineering Council now constitutes a system analogous to that under which the government of the United States functions, says Gardner S. Williams in a prepared statement interpreting the Council's revised constitution. The new constitution permits the re-election of the president, an office now occupied by former Governor James Hartness of Vermont. Mr. Williams, who is a vice-president of the Council, says:

"The first change in the revision is the dropping of the name 'Federated American Engineering Societies' and replacing it by 'American Engineering Council' which now stands for the association of societies. The administrative and legislative body, formerly called the American Engineering Council is now designated the Assembly. The name of the Executive Board is changed to Administrative Board and the Committee on Procedure becomes the Executive Committee.

"The next change is in the provision for membership where it is made possible for technical sections or divisions of non-engineering organizations to be admitted to membership, as well as alumni associations of engineering schools and sections of non-member national societies, none of which seemed to be included under the original constitution."

The most important change is in Section II of Article IV, wherein the established practice of the Council is so defined as to prevent hasty or ill-considered action being taken over the opposition of even a comparatively small minority, and to assure substantial unanimity on all matters of major importance. It gives to each of the large national societies the power to stop action and, according to Mr. Williams, should fully answer the charge that they may be swamped by the votes of the smaller local societies.

Institute of Metals Meeting Set for March

The annual meeting of the Institute of Metals will be held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, England, on March 12 and 13. The presidential address will be delivered by Prof. T. Turner. The annual dinner will be held March 12. For the first time in the Institute's history, the membership passed the 1,500 mark on Dec. 31, 1923.

Report on Standardization to Be Issued

The fourth National Standardization Bulletin of the American Mining Congress will carry very comprehensive reports on standardizing mining methods, practice and equipment as applied to mine timbering (coal and metal); mine drainage (coal); mine ventilation (metal); underground transportation (coal); mechanical loading underground (metal); firefighting equipment (metal); drill steel (metal); and mining and loading equipment (coal).

Recent Technical Publications

Reviews, Abstracts, and References

A Nevada Directory

Mining Districts and Mineral Resources of Nevada. By Francis Church Lincoln. Nevada News Letter Publishing Co., Reno, Nev. Price $3.

In 1912 the U. S. Geological Survey published Bulletin 507, by James M. Hill, on the mining districts of the Western United States. This useful compilation gave maps and important references about individual mining districts. In the twelve years that have passed many changes have taken place in the mining districts of these states. Individual states have published from time to time résumés of their mining activities and the Mines Handbook has maintained a general directory of information about mining companies, but these often lack completeness. In the instance of Nevada, a compilation of the important information about its mining districts has been made under the foregoing title by Francis Church Lincoln and published by private enterprise.

The book is divided into two principal parts, one on mining districts and one on mineral resources. The section on mining districts is organized on the basis of counties under each of which the various districts are alphabetically arranged. The principal metal or non-metallic mineral produced is given under the name of the district, and then follow detailed notes on location, history, geology, and bibliography. The more important mines are also mentioned. Production statistics where they are available are given for recent years. A general map of the state indicates by number the geographic position of each district, of which 307 are listed.

The second part, dealing with the mineral resources of the state, lists the individual metals and non-metallic minerals alphabetically and gives the county and district in which they occur, together with general comment and a bibliography. In addition, statistics of the state's production of each individual metal and non-metallic mineral of more than nominal importance are presented.

The book has been conscientiously compiled and its 295 pages represent a great deal of work. It should prove useful to mining men who are interested in Nevada and should encourage other states to issue similar publications. GEORGE J. YOUNG.

"Fluorspar Deposits of Kentucky," by L. W. Currier, a bulletin of 189 pages, 42 illustrations, and one map, has recently been published by the Kentucky Geological Survey, Frankfort. Such a state report is opportune, for there is a growing tendency during recent years on the part of both producers and consumers to view with some degree of uncertainty the adequacy of present sources of supply of fluorspar to meet future domestic requirements, in branches of the steel and chemical industries where it is regarded as essential. The western Kentucky fluorspar district is the most important in the country, being exceeded in production only by the adjacent district in Illinois. The first eight chapters of Mr. Currier's report deal with the origin, geology, descriptive details, and development of these deposits. The discussion of origin and occurrence of the mineral provides data of value in development of the deposits. The author associates the fluorspar in origin with deep-seated basic intrusives, and this theory suggests fluorspar mineralization to a depth of at least 1,400 ft. In lateral extent the deposits are probably limited to the higher parts of the underlying batholith and are thus confined to certain "centers," while the probability of a development in Kentucky equal to that in Illinois is suggested, the author makes no general or specific claims regarding reserves. The central field in Mercer and Woodford counties, covered in chapter 9, is of minor importance. Users, sources of supply, production, prices, imports, and exports comprise Chapter 10, and an appendix gives a list of Kentucky operators. OLIVER BOWLES.

Patents

Treatment of Iron Ore—No. 1,472,131. Oct. 30, 1923. A. J. Moxham, New York City. Pure iron is obtained by leaching the ore with a solvent for iron, separating the solution from the gangue, evaporating the solution and heating to form oxide; reducing to the magnetic oxide with carbon and heat; and separating the reduced oxide by magnetism.

Ore Washer—No. 1,476,243. Dec. 4, 1923. Antoine France, Liege, Belgium. An apparatus for thoroughly soaking finely ground minerals preparatory to treatment in a wet-sorting apparatus. Two tanks are provided; one for containing the pulp and the other as a supply cistern.

Hydraulic Classifier—No. 1,476,250. Dec. 4, 1923. R. S. Handy and Edward Hearing, Kellogg, Idaho. A trough-shaped classifier having a series of settling chambers arranged lengthwise thereof. Below each settling chamber is a pressure chamber with an inlet and outlet for water, and means for regulating the pressure.

Electrolytic Cell—No. 1,476,251. R. S. Handy, Kellogg, Idaho. An electrolytic cell comprising two concentric cylindrical housings between which is a helical passage for the electrolyte, and in which is a pair of anodes. A cylindrical cathode is placed between the anodes.

Flotation Agent—No. 1,476,530. Dec. 4, 1923. E. W. McCullough, Indianapolis, Ind., and R. E. Wilson, Minneapolis, Minn., assignors to P. C. Reilly, Indianapolis. A combination of a coal-tar distillate which distills at above 700 deg. F., and a solvent.

Metallurgy of Bismuth—No. 1,477,321. Dec. 11, 1923. E. R. Darling, Montclair, N. J., assignor to Ellis-Foster Co. A solution of a bismuth salt is first formed, the free acidity neutralized in the presence of a substantial amount of a saline body, and an oxy-compound of bismuth precipitated by diluting the solution.

Grinding Mill—No. 1,477,376. Dec. 11, 1923. E. H. Moyle, Los Angeles. A cylindrical mill with hollow trunnions for feed and discharge, the grinding being done between a rotary ring shoe and a ring die.

Ore Concentration — No. 1,477,476. Dec. 11, 1923. B. H. Dosenbach, Butte, Mont.; E. M. Dosenbach, executrix. The ore is reduced to a wet pulp, acid added to dissolve the mineral, and the pulp settled. The clear solution is overflowed and the metallic compound precipitated. The dissolved mineral is also precipitated in the thickened pulp from which it is separated by flotation.

Hydrometallurgy of Zinc—No. 1,477,478. Dec. 11, 1923. J. O. Elton and R. B. Caples, Great Falls, Mont., assignors to Anaconda Copper Mining Co. Residues containing gelatinous material derived from the lixiviation of roasted zinc ores with sulphuric acid are mixed with sulphuric acid. The mixture is then heated to a temperature short of that at which zinc sulphate is decomposed but sufficient to insure the decomposition of most of the iron sulphate and the dehydration of gelatinous material.

Acid Solution—No. 1,477,965. Dec. 18, 1923. E. S. Leaver, Tucson, Ariz., assignor of one-third to C. E. van Barneveld, St. Louis, and one-third to L. R. Eckman, Tucson. Material containing ferrous sulphate in the presence of water is subjected to the action of gases containing sulphur dioxide and oxygen, the product being a mixture of sulphuric acid and ferric sulphate.

Fuel-ore Briquets — No. 1,478,215. Dec. 18, 1923. Carl Giesecke, Bad Harzburg, Germany. Fine ore is mixed with pulverized fuel and water, the mixture extruded through a suitable die, and the moulded material cut into pieces suitable for charging to a blast furnace.

Rock Drills—No. 1,478,220. Dec. 18, 1923. C. C. Hansen, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. An oiling device for rock drills.

Mineral Separation—No. 1,478,295. Dec. 18, 1923. W. G. Perkins, London, England, assignor to Metals Production Co. of North America, Inc., New York City. Metallic sulphide ores containing pyrite are ground to suitable size and heated in an atmosphere of steam at such a temperature and for such a time that the surfaces of the pyrite particles only are affected, they being rendered paramagnetic to facilitate their magnetic separation from the other minerals present.

MEN YOU SHOULD KNOW ABOUT

Charles W. Merrill of San Francisco is in New York.

J. B. Tyrrell, of Toronto, has returned from a visit to London.

L. W. Stephenson, petroleum geologist, has returned from South America.

Frederick G. Clapp is in Australia, where he will spend several months in oil investigations.

H. S. Denny, of London, is examining gold properties in Northern Ontario on behalf of English interests.

W. F. Green has been appointed instructor for a ten weeks extension course for prospectors at the University of Toronto.

W. H. Carrick, of the Bureau of Mines staff, has made an examination of the scene of the recent mine disaster at Milford, Minn.

E. V. Neelands, assistant manager of the Jacobs Asbestos Co., Quebec, has been appointed manager of the Keeley mine, in South Lorrain.

Hugh Park, assistant manager of the Nipissing mine, Cobalt, has been appointed general manager, succeeding the late Rollo B. Watson.

Forest Rutherford now has his office at 50 Broad St., New York, and not at 50 Church St., as was erroneously stated in our issue of Feb. 2.

Edwin Burt recently returned from Chile where he has been securing data regarding the performance with caliche fines of the filter of his invention.

H. C. Dudley, of Duluth, has been in New York and is now at Pasadena, Calif. He will be going to Ahumada mine in Chihuahua, Mexico, in the near future.

W. B. Webb, of Gilbert, Minn. has succeeded **Herbert C. Jussen** in the management of the Townsite mine, at Ironwood, Mich., operated by the Republic Iron & Steel Co.

H. W. Gepp, general manager of the Electrolytic Zinc Co. of Australasia, Risdon, Tasmania, is about to visit Great Britain and Europe. He expects to leave early in March.

Malcolm H. Carpenter, formerly manager of the San Francisco branch of the Mine & Smelter Supply Co. has taken over the managership of the El Paso branch of that company.

Joseph Myers, managing director of the Bingo Mining Co. of Manitoba, is in England for the purpose of raising £75,000 additional capital for the development of hydro-electric power.

Hugh F. Marriott has accepted the position of consulting engineer to the Sabie Gold Mining Co., operating in the Northern Transvaal. He is now on his way to Greece to investigate a property there.

G. H. Parsons, assistant manager of the Master Products Co., operating non-metallic mines at Death Valley, Daggett, Calif., and Porterville, Calif., is in New York in the interests of his company.

Charles Janin and **Ross Hoffman** are en route to London on professional business understood to be in connection with the resumption of certain mining activities in Russia on the part of British companies.

Fred Searles, Jr., has been appointed chief geologist of the U. S. Smelting & Refining Co. He will be in charge of exploration for the company's operations in the United States and will maintain headquarters in Boston.

W. H. Berg, H. D. Collier and **R. W. Hanna** have been elected by the present board of directors as new directors in the Standard Oil Co. of California. The membership of the board was increased from seven to ten recently.

Donald H. Fairchild has returned from Nacozari, Sonora. While in Nacozari he visited the plant of the Moctezuma company. Mr. Fairchild remained in Douglas for about ten days, after which he returned to Nacozari for a further short visit.

Percy E. Hopkins

Percy E. Hopkins, Assistant Provincial Geologist of Ontario, will soon leave the government service to accept a position with the Mond Nickel Co.

John G. Kirchen has been re-elected president of the Nevada Mine Operators' Association. **Arthur H. Laury** was elected first vice-president; **A. S. Winther**, second vice-president and **Henry M. Rives** was re-elected secretary.

Joseph B. Umpleby has announced his resignation as director of the school of engineering geology of the University of Oklahoma to become vice-president of the Goldelline Oil Corporation, with offices in the Braniff Building, Oklahoma City.

Arrangements have been made whereby a series of lectures are to be delivered at Johns Hopkins University by geologists on the staff of the U. S. Geological Survey. These presentations will be made by K. C. Heald, D. F. Hewett, G. F. Loughlin, H. G. Ferguson and Frank Hess.

Philip S. Smith, in charge of the Geological Survey's party that will engage in geologic work in the Arctic oil fields of Alaska, is in Tanana where he is making contracts for heavy freight to be carried to the upper Colville region. He has purchased four dog teams for his party.

John A. Fulton has resigned the managership of the Idaho-Maryland mine, at Grass Valley, Calif. Mr. Fulton has been in charge of the exploration work in the Idaho-Maryland since it was taken over by the Metals Exploration Co. and has conducted a persistent search for ore, which resulted in the discovery of several small orebodies.

Dr. J. A. Gray, associate professor of physics at McGill University, Montreal, who has been carrying on an important investigation in connection with Roentgen rays, has resigned his position to accept the Crown research professorship of physics at Queen's University, Kingston, Ont., which will afford him greater opportunities for research work.

Louis F. Clark has accepted a position as metallurgical engineer with the Cerro de Pasco Copper Corporation. He is at the company's experimental plant, at South Kearny, N. J. In December, 1923, Mr. Clark and Miss Marjorie Calder were married in Grand Rapids, Mich.

Philip L. Smith, who had formerly been with Naylor & Co., Inc., continuously for twenty years, recently relinquished his interests in William H. Mills & Co., Inc., to assume the management of the ore and metal department of H. Hollesen, Inc., importers and exporters, New York, N. Y., with connections and representatives in the principal markets of the world.

P. G. Paris, director of the Westport mill, investigation and testing laboratory of the Dorr Company, has resigned to return to the Bethlehem Steel Co., with which he was formerly affiliated. He will be connected with the patent and research department and will be a consultant on ordnance work. **J. A. Baker**, who was formerly connected with the Dorr Company will in the near future assume the directorship of the Westport mill.

L. K. Armstrong, mining engineer of Spokane, was recently honored by being made a life member of the American Institute of Mining & Metallurgical Engineers. The appointment was made in recognition of his invaluable services to the Institute. For many years Mr. Armstrong has been the secretary of the Columbia Section of the Institute and has been untiring in his efforts to build up the most enthusiastic personnel of any of the local branches of the A.I.M.E.

James Hartness, former Governor of Vermont, and past president of the American Society of Mechanical Engineers, was elected president of the American Engineering Council to succeed Dean Mortimer E. Cooley, of the University of Michigan, at the annual meeting of the Council, which was held in Washington Jan. 10 and 11. Vice-presidents elected were **L. P. Alford**, of New York, and **Charles R. Gow**, of Boston; **Calvert Townley**, of New York, and **Gardner S. Williams**, of Ann Arbor, Mich. **Dr. H. E. Howe**, of Washington, was re-elected treasurer, and **L. W. Wallace**, of Washington, was again chosen executive secretary.

New Machinery and Inventions

Mechanical Haulage for the Small Mine

New Locomotive Can Be Moved from Level to Level With Ease

A locomotive to meet haulage conditions in small mines or for work on those levels of large mines where the tonnage handled is small is being offered to the mining public by the Mancha Storage Battery Locomotive Co., of St. Louis, Mo. This locomotive has been called the "Little Trammer" and its purpose is to displace hand trammers entirely, also mules and drivers, regardless of the small tonnage which may be hauled on each level. It is so small that it can be run onto the ordinary mine cage like a mine car and transferred quickly from one level to another—as quickly as the mine car itself.

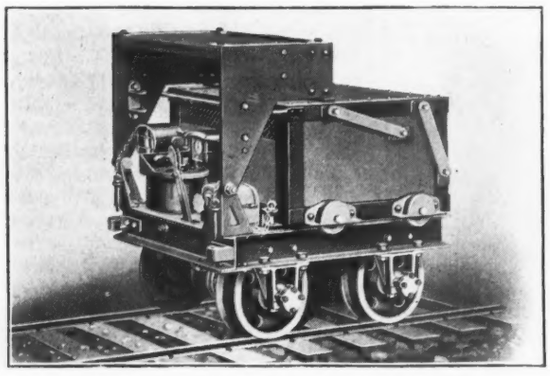


Fig. 1. Locomotive with operator's cockpit up, ready to go on cage

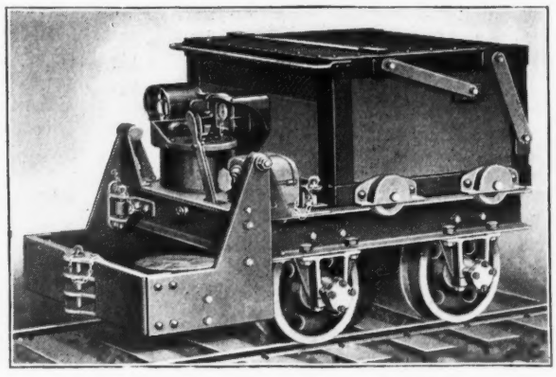


Fig. 2. Locomotive with cockpit down, in running position

The operator's cockpit is pivoted like a visor so that it can be thrown up on top of the battery box when the locomotive goes on the cage. In this position the overall length is 47 in. and the width (at all times) is 32¾ in. See Fig. 1.

The locomotive is worm-driven. It is made ready for hauling, after reaching the level upon which it is to work, by dropping the visor back into place, in which case it again becomes the operator's cockpit. See Fig. 2. The battery is of sufficient capacity to displace a considerable number of hand trammers. Where additional battery capacity is required, the discharged battery can be removed and a fully charged battery can be placed upon the chassis by means of the Mancha transfer rack in three to five minutes' time. In practice, it is believed that this will usually be done on the surface at the central charging station, as the charging of the batteries will probably be done after the hauling has been finished on any one level.

The heaviest piece in the locomotive will be approximately 300 lb., which makes it possible to transport it on mule back in isolated sections. It is claimed that this small locomotive will cut mine-haulage costs very perceptibly in mines which have been formerly using hand trammers and mule haulage.

Utilizing the Continuous Vacuum Filter Underground

Removes Abrasive from Mine Water to Facilitate Pumping

By A. W. ALLEN

One of the most recent examples of the wide applicability of the continuous vacuum filter for purposes other than those for which it was specifically designed in the first instance is shown by the erection of a large Oliver machine underground in one of the properties of Crown Mines, Ltd., at Johannesburg, South Africa. The freeing of a comparatively large amount of highly abrasive grit during drilling operations, and the contamination of the water raised to the surface, introduced problems that called for consideration of a corrective. It was first thought that the grit and slime could be settled in sumps, the supernatant water going to the pumps and the sediment being baled to the surface at intervals. The objection to this plan included the disadvantage of intermittent operation, imperfect dewatering and general sloppiness of procedure. It was finally decided to settle the solids and to convey the thickened pulp to an Oliver filter erected at one of the lower levels of the mine, the clear water going to the pumps and the filter cake passing by belt conveyor to the ore bins, for haulage to the surface.

The increased use underground of what has been known as typical surface equipment is a significant step in the direction of a more complete utilization of past invention and available apparatus. The ease and safety and efficiency with which electric power can be transmitted underground to the exact spot where it may be needed has facilitated this development. In many instances, particularly in deep mines, pumping represents a heavy expense, and the problem is complicated if any appreciable proportion of grit is included in the flow to the sumps. The alertness of mining men in South Africa in adopting unusual means to reduce costs is paralleled by the acumen and foresight of American inventors and manufacturers in perfecting equipment that can do the work.

"Wired Wireless" Something New in Telephony

Uses Existing Transmission Lines — Application of Principle May Be Useful in Mine Work

A new system of telephony has been developed by the Westinghouse Electric & Manufacturing Co. that will probably interest mine operators, because of the possibilities it offers for underground as well as for surface use. This involves an application of the principle of carrier current communication, which is a development of the radio art whereby communication may be established between points on a power or electric railway system by using the existing transmission lines as a channel of communication. The transmission line conductors serve as a path along which high frequency waves are guided, rather than sent broadcast as in ordinary space radio. The carrier current telephone system does away with the necessity of installing and depending upon ordinary telephone lines, allows the use of relatively rugged power transmission lines as the channel of communication and thus offers a more economical and more dependable solution of the communication problem of electric railroad and power companies.

The Westinghouse company has developed a telephonic application of the carrier current principle, which it claims is superior to wire telephone systems now in use.

It has been the practice, for the sake of economy, to string wire telephone lines on the power company's right of way. Ordinarily they are either carried on the transmission line towers or are on wood poles beneath the transmission line. With either arrangement, the towers must be built higher to get sufficient clearance, particularly where regulations regarding ground clearance are in effect. Furthermore, the telephone line is always relatively near to the high voltage transmission line. Such proximity of telephone line to the power line causes disturbing interference, which at times is sufficient to make the telephone line inoperative and, furthermore, frequently induces a dangerously high potential on the telephone line. Storms frequently whip the telephone line up into the transmission line, especially on the longer spans,

and during severe storms the telephone line is very frequently parted on account of its relatively small diameter.

The initial cost and maintenance of a carrier current system are said to be, in general, considerably below these items for wire telephony.

A carrier current station consists of a transmitter and a receiver. The transmitter is essentially a generator of radio frequency alternating current (the "carrier current") and apparatus for modulating this current in conformity with voice impulses, similar to radio broadcasting transmitters. The receiver is similar to the ordinary conventional radio receiver, designed, however, for wave lengths greater than those commonly found in broadcasting receivers, and consisting of a two-circuit tuner, vacuum tube detector and one amplifier. These two pieces of apparatus are each connected to an antenna, which is coupled to the transmission line. These antennae are single conductors coupled by being run on insulators on the transmission towers as close to the transmission conductors as safety will permit. There are also the usual telephonic appurtenances, the desk stand set consisting of microphone transmitter and receiver selective ringing devices, and various actuating devices.

Radio Impulses Guided Along Paths

It will be seen, therefore, that the system differs from the ordinary wire telephone in that telephone wires are not used, and from the ordinary space radio, in that radio impulses are guided along certain desired paths. The overall result is a telephone system in which the telephone wire construction, involving expense and delay, is unnecessary, installation is quickly and easily effected at a relatively small cost, and reliability is greater than with any other system.

Communication is duplex. Conversation may be carried on in both directions at the same time just as in ordinary wire telephone operation. The telephone desk set and call bell are the only parts of the carrier current equipment that need to be in the office of the operator. If equipped with a wire line extension unit, this desk set can be located at practically any distance from the carrier current equipment, and can be connected thereto by two wires. The only requirement of these two wires is that they shall, in themselves, comprise a good talking circuit reasonably free from inductive interference.

The power of the standard set described herein is sufficient to take care of any average power system under all operating conditions. Reliability is thus maintained on a very high plane.

The operation of the Westinghouse carrier current system is extremely simple. The same operators can use the carrier current system and the wire telephone line with no confusion.

The maintenance of the carrier current system thus described is restricted almost entirely to tube replacements, the cost of which is moderate.

The protection feature of this system makes for absolute safety to the operating personnel, and insures reliability of operation through preventing damage to the operating equipment.

Novel Diamond Drill Equipment for Deep Boring for Oil

The Diamond Drill Contracting Co. of California, of Los Angeles, has recently issued a booklet dealing with the subject of diamond-drill boring for petroleum. The equipment developed for this purpose is novel. The important parts consist of a hydraulic

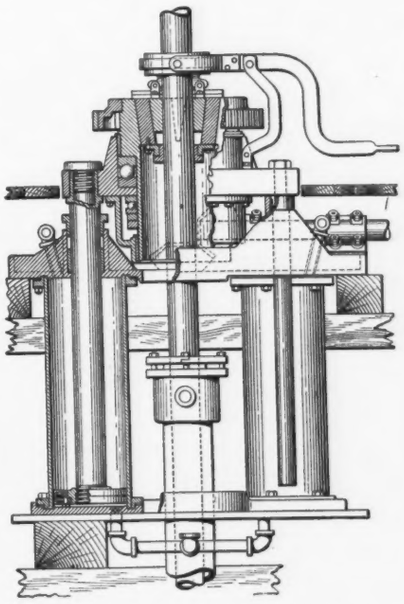


Fig. 1—Assembled chuck holding drill rod, and table supported by hydraulic cylinders

feed and rotating table for handling the drill rod, control and driving mechanism directly connected to the hydraulic table by a shaft and gear drive, a special direct drive steam engine, a hydraulic pump for feeding the hydraulic cylinders, a rotary mud pump for circulation, and diamond bits.

The drill rod chuck and hydraulic cylinders are shown in the accompanying cuts. A master grooved bushing

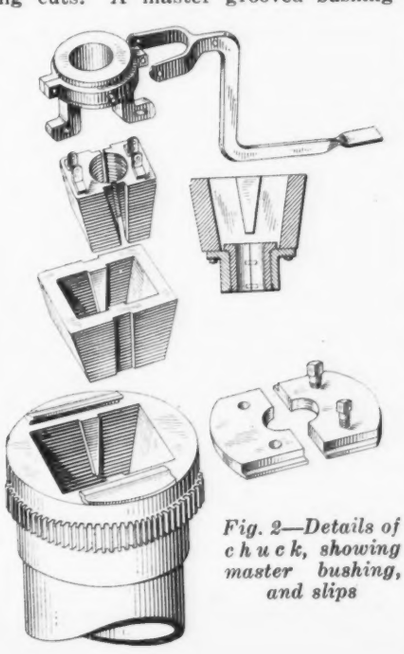


Fig. 2—Details of chuck, showing master bushing, and slips

receives the slips, which take hold of the drill pipe over their whole contact area as they reach position. The slips are made of manganese steel. The rectangular form of the bushing prevents the slips from rotating with the pipe. The drill-stem guide bushing which seats in the bottom of the master bushing insures the adjustment of the drill pipe and the even pressure of the slips. The slips are raised and lowered by a loose collar and lever. The slips will engage in the event of the breaking of a cable when pulling the drill rod. To apply downward pressure upon the drill rod two cover slips are provided which are slid under the guides on the table and are bolted to the master bushing, thus preventing the slips and bushing from loosening and being forced upward. A bearing-down pressure of 100 tons can be exerted. The standard equipment will accommodate up to 14-in. diameter pipe. Larger sizes up to 24-in. require special attachments.

Power is applied by a vertical shaft operated by inclosed gears. The sand reel has a capacity of 6,000 ft. of ⅝-in. line. The hoist drum carries 800 ft. of 1-in. line. A link-motion engine, 10 x 10.5-in. cylinders, is used. High-speed gears are provided for diamond drilling and slow-speed gears for the fish-tail drill.

The diamond bit is provided with deep grooves for the circulation of the mud fluid. The usual size of bit for petroleum drilling is 8 in. but bits up to 12 in. in diameter can be made. A core barrel and spring gripper clip are used. Cores can be taken up to a length of 60 ft. Two hydraulic cylinders are used to control the drilling. The standard supporting the turning head is held in position by four guide rods which move upward or downward whenever the hydraulic cylinders are operated.

Building up Abraded Steel Wearing Parts

It often happens that manganese-steel wearing plates abrade at one or more points, and that the efficiency of the machine in which they are used is reduced because of the absence of perhaps only a small proportion of the metal in the original casting. As an example: Maximum abrasion of the wearing plates of jaw crushers usually occurs, often forming pockets, at or near the point of discharge, with the result that an increasing amount of oversize leaves the machine. Decreasing the opening by bringing the jaws closer together is a temporary remedy but an unsatisfactory one.

The building up of the torn parts by means of electric- or gas-welding equipment and the use of manganese-steel welding rods considerably lengthens the life of such wearing parts and prevents the wide variation in the size of the product that detracts so much from efficient operation. The welding rods are also available for renewing worn steel parts of track and for other purposes around mills, mines, smelters and industrial plants. They are manufactured by the Manganese-Steel Forge Co., of Richmond Street and Erie Avenue, Philadelphia, Pa.

THE MARKET REPORT

Daily Prices of Metals

Feb.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
14	12.75	54.25	54.75	8.45	8.30@8.75	6.75@6.80
15	12.875	54.50	55.00	8.60	8.625@9.00	6.85
16	13.00	54.75	55.25	8.60	8.625@9.00	6.90
18	13.20	54.50	55.00	8.70	8.675@9.00	6.90
19	13.20	53.25	53.75	8.70	8.75@9.00	6.90
20	13.125	53.50	54.00	8.70	8.75@9.00	6.90
Av.	13.025	54.125	54.625	8.625	8.790	6.871

*These prices correspond to the following quotations for copper delivered: Feb. 14th, 13.00c.; 15th, 13.125c.; 16th, 13.25c.; 18th and 19th, 13.45c.; 20th, 13.375c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Feb.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
14	63½	64⅜	68¼	280¾	277½	34¼	33¼	36½	35¾
15	64¾	65⅝	69	281	277¾	34⅝	33¾	37	36½
18	66⅛	66⅞	70½	284¾	281½	35	34½	37½	37
19	64¼	65⅛	70	280	276¾	35	34⅛	37⅜	37⅛
20	64	64⅞	70	275⅞	272⅞	34¾	34	36¾	36⅛

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Feb.	Sterling Exchange "Checks"	Silver		Gold London	Feb.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
14	4.29⅝	65¼	34 1/16	96s 2d	18	4.28¾	64⅝	33¾	96s 2d
15	4.29⅞	65	33⅞	96s 0d	19	4.29	64¼	33 9/16	96s 2d
16	4.28⅜	64⅞	33⅝	.....	20	4.29¼	64	33 7/16	96s 2d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, Feb. 20, 1924

The general advance in the nonferrous metal market has continued during the last week, with copper, lead, zinc, antimony, and tin all moving into new high ground. Spring bookings by manufacturers and fabricators seem to be more than expected and no lull in demand is yet apparent.

Copper

The advance in copper prices which began last week has continued. On Thursday, Friday, and Saturday successive increases in price were registered on only a moderate amount of buying, so that by Monday, 13¼c. was quoted by practically everybody. On both Monday and Tuesday a substantial tonnage of copper was sold at that figure, and even higher in some instances. On the other hand, early Monday and late Tuesday, 13⅜c. could have been done, and the lower price is quoted in several directions today, so that the peak seems to have been reached and passed for the time being. The undertone is distinctly firm however, and with most producers well sold up it is unlikely that there will be much pressure on the market. Very few orders were booked today. The export market has been satisfactory all week, 13¾c., c.i.f. being realized yesterday.

Lead

The official contract price of the American Smelting & Refining Co. was advanced from 8.25 to 8.40c. on Thursday, Feb. 14, and to 8.50c., New York, on Feb. 15.

Producers seem to have found more lead than they had counted on having for sale, for a much larger proportion of the inquiries have been filled during the last week than for some time. The business has been well distributed, orders being numerous on both the St. Louis and New York basis. The easier conditions of supply have not affected the price adversely, however, and for February and early March shipment 9.25@9.40c. has been paid for substantial tonnages which had become available. There is no difficulty in getting April and May lead at 8½c., New York, and in fact, some business was done at this level for nearer-by positions. Dealers in the Middle West continue to quote above 9c. for St. Louis lead but producers are taking care of their regular customers at from 8¾@9c. Mexican lead continues to be sold in this country.

The lead market continues in an unsatisfactory condition from the standpoint of those consumers who find themselves short of this metal. Producers, in an effort to prevent a runaway market, with a probable undesirable reaction, are selling small lots to regular customers for considerably less than might be obtained in the open market.

Zinc

Zinc has again been in good demand all week up to today, both galvanizers and brass makers coming into the market. Yesterday, it was possible to sell for export profitably but today the London market is substantially down. This is no doubt a reaction from the rather rapid advance over the week-end; also the dock strike probably has an influence. The recent advance in Prime Western has carried high-grade to higher levels, 8½@8¾c., delivered, now being quoted.

Tin

Tin has again had an active market, with the speculators much in evidence as well as buying by consumers. The presence of C. M. Ricard in New York seems to have aided in stirring up the market. Forward tin has, in general, been sold for from one-quarter to three-quarters of a cent less than spot. As usual, 99 per cent has been largely nominal.

Arrivals to Feb. 19 total 5,315 long tons.

Circulation Statement

Stock of money in the United States, Feb. 1: Gold coin and bullion, $4,289,-

292,931; standard silver dollars, $499,132,769; subsidiary silver, $277,630,839; United States notes, $346,681,016; Federal Reserve notes, $2,601,140,070; Federal Reserve Bank notes, $13,414,170; National Bank notes, $772,796,769; total $8,800,088,564. Circulation per capita, $41.77. Gold stocks increased about $42,000,000 and outstanding notes decreased about $221,000,000.

Foreign Exchange

Francs have made further important declines and lire are also lower than last week. Sterling has held steady.

On Tuesday, Feb. 19, cable quotations on francs were 4.1775c.; lire, 4.295c.; and Canadian dollars, 2 3/32 per cent discount.

Silver

The recession in price during the past week was due chiefly to the slackening of China's demands, although continued lack of interest at the higher figures on the part of India and slightly lowered sterling exchange rates were contributing factors.

Mexican Dollars — Feb. 14th, 49⅜; 15th, 49⅝; 16th, 49½; 18th, 49⅜; 19th, 49; 20th, 48⅞.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade 28c. per lb.; 98 per cent, 27c. London, £115 per long ton.

Antimony—Per lb.:

Chinese and Japanese brands, 11@11½c..

W. C. C. brand, 12½@13c.

Cookson's "C" grade, 14½c.

Bismuth—$2.35@$2.45 per lb. London, 10s.

Cadmium—70@75c. per lb. London, 2s. 6d.

Cobalt—$2.50@$3 per lb. for spot.

Iridium—$275@$300 per oz.

Nickel—26@30c. per lb. for 99 per cent virgin metal. London, £130 long ton.

Osmiridium — Crude, $58.50 per oz.

Palladium—$83 per oz. Crude, $60 per oz.

Platinum — Refined, $125 per oz. Slight shading of prices in some quarters. Crude platinum, $115@$117 per oz.

Quicksilver—$59@$61 per 75-lb. flask. The market is as quiet as ever but there is less tendency to sell below import prices. San Francisco wires $60.00. London, £9 15s.

The prices of **Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium, Thallium,** and **Tungsten** are unchanged from prices given Feb. 9.

Metallic Ores

Chrome—$19.50@$24, depending upon grade and source. Nominal.

Manganese—42@46c. per long ton unit, seaport, plus duty.

Molybdenum—80c. per lb. of MoS_2 for 85 per cent concentrates. Nominal.

Tungsten Ore—Per unit, N. Y:
High-grade wolframite, $8.50.
High-grade scheelite, $9.50@$10.
Ordinary grades, $8.50@$8.75.

Iron Ore, Magnetite, Tantalum, Vanadium, and **Zircon Ore** are unchanged from Feb. 9 quotations.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 16—Zinc blende per ton, high, $46.90; basis 60 per cent zinc, premium, $46@$47; Prime Western, $44@$45; fines and slimes, $43@$41; average settling price, all zinc blende, $44.44. Calamine, basis 40 per cent zinc, $24 per ton.

Lead, high, $121.35; basis 80 per cent lead, $121, offerings, no sales; average settling price, all lead ore, $116.38 per ton.

Shipments for the week: Blende, 15,368; calamine, 31; lead, 1,610 tons. Value, all ores the week, $871,130.

Weather was admirable all week for loading and the shipments were 3,685 tons more than the preceding week, and 3,400 tons more than the purchases this week, which totalled but 12,040 tons. Output is estimated around 14,000 tons. Large stocks are practically depleted, and while this ore was being shipped, an accumulation has congested bins at many of the smaller producers.

Platteville, Wis. market not received at time of going to press.

Non-Metallic Minerals

Asbestos:

Crude No. 1—$300@$400.
Crude No. 2—$175@$225.
Spinning fibers—$90@$125.
Magnesia and compressed sheet fibers—$60@$90.
Shingle stock—$50@$70.
Paper stock—$32.50@$40.
Cement stock—$20@$25.
Floats—$7@$9.

All per short ton, f.o.b. mines, Quebec, tax and bags included.

Bauxite, Barytes, Beryl, Borax, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Graphite, Gypsum, Ilmenite, Limestone, Magnesite, Manjak, Mica, Monazite, Phosphate, Pumice, Pyrites, Rutile, Silica, Sulphur, Talc are unchanged from Feb. 9 prices.

Mineral Products

Arsenious Oxide (white arsenic)—12c. per lb. Recent meager demand has caused shading of prices. Impure imported arsenic offered at concessions.

Copper Sulphate—4.75@4.85c. per lb.

Potassium Sulphate, Sodium Sulphate and **Sodium Nitrate** are unchanged from the Feb. 9 prices.

Ferro-Alloys

Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from the prices given in the Feb. 9 issue.

Metal Products

Copper—Sheets, 21c. base; wire, 15½c.

Lead Sheets—Cut, 10.50c.; full, 10.25c. per lb.

Nickel Silver—18 per cent Grade A sheets, 27½c.

Yellow Metal — Dimension sheets, 18¾c.; rods, 15¾c.

Zinc Sheets—Base price, $9.75 per 100 lb., f.o.b. plant.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the Feb. 9 prices.

The Iron Trade

Pittsburgh, Feb. 19, 1924

Steel mill operations have been practically holding their own the past week, after the remarkable increase in the first five weeks of the year and particularly in the first two or three weeks.

It cannot be said that the demand for steel is broadening at present in company with the progress of time toward spring, the natural time for the steel market to become more active. It is even doubtful whether the volume of turnover in steel products, as a whole, was as great at the middle of February as at the end of January, and it is also doubtful whether the slight price irregularities in some spots in the market in January have since diminished.

Conditions as to the consumption of steel must be regarded as quite satisfactory, as all the consuming lines are reasonably busy and most of them are quite busy, but the situation now reached is not one adapted to stimulating confidence, the market having improved so much in the latter part of December and in January that it has no room left for improvement, and a slight backset now would have an unfavorable influence upon sentiment, particularly in view of the stock market declines that began last Friday.

Freight car buying is making a fair showing. Both the Pennsylvania and the New York Central are negotiating to place moderately large orders.

Late in the afternoon of Feb. 18 the American Sheet & Tin Plate Co. announced opening of its order books for second quarter, at unchanged prices. Tin plate had already been well sold to July 1, but second quarter terne plate remained to be sold to jobbers. The pressure for opening was caused by the automobile trade, which wished to place orders for second quarter in automobile sheets, possibly in blue annealed also. Prices are: Blue annealed sheets, 3c.; black sheets, 3.85c.; galvanized sheets, 5c.; automobile sheets, 5.35c.

Pig Iron—The market has been dragging, with little inquiry and very little buying. Recently advanced asking prices, $24 for bessemer, $23 for basic and $24 for foundry, f.o.b. valley furnaces, are obviously unobtainable. The Westinghouse Electric & Manufacturing Co. after a fortnight of negotiating is closing on 2,500 tons of foundry iron for Cleveland and 1,500 tons for Trafford, and has been quoted under $23, valley basis. The market is quotable practically nominal at $23.50 for bessemer, $22.50 for basic and $23.50 for foundry, valley basis.

Connellsville Coke—Spot supplies of furnace coke are very scant and the market is stiff, about $4@$4.25, with the latter price bid in one case on particularly good coke. Second quarter negotiations have languished and it is plain that the advanced asking price of $4.50 cannot be obtained. A little business has been done at $4.25 and several inquiries have been withdrawn entirely.

Largest Copper Seller Finds European Situation Hopeful

New German Monetary System on Trial—Copper Export Association To Continue Past Practice

By Felix Edgar Wormser
Assistant Editor

THE MOST important copper selling agencies in the United States, those who, together, dispose of 90 per cent of the North and South American production, can be counted on the fingers of one hand. The thumb of this hand might well be considered as Edward Mosehauer, vice-president of the Metals Sales Corporation. Since the reorganization of the Anaconda selling interests—the Metals Sales Corporation and the Copper Export Association—Mr. Mosehauer will sell more copper than any other agent, and more copper than has ever come under his jurisdiction. The Metals Sales Corporation now markets the production of Chile, Ray Consolidated, Chino, Greene Cananea, New Cornelia, Inspiration, North Butte and Utah Consolidated Copper Mining Companies.

A Familiar Figure in the Copper Market

Mr. Mosehauer has spent the best part of his life selling copper. He was with the firm of Lewisohn Brothers initially and then with the United Metals Selling Co. both in the United States and in Berlin before the war. He performed signal services for the copper producers during the war, in Washington as their representative. After the war he spent a year in Europe for the Copper Export Association. When the Anaconda Copper Mining Co. absorbed the Chile Copper Co. he became sales agent for the Chile Exploration Co. Mr. Mosehauer enjoys a wide acquaintance with copper manufacturers and other business men in Europe and the United States. Recently he returned from a short trip abroad in the interests of the Copper Export Association. Being an unusually keen observer and having an intimate knowledge of Europeans and European methods his observations should be interesting to the copper industry which has such a large stake in the recovery of Europe. There is no question of the copper requirements of that continent provided means can be found to finance the purchases.

Not Worrying Over Labor Government in England

Mr. Mosehauer found England less disturbed over the inauguration of the Labor Government than it was anticipated would be the case. The Labor Government will find it difficult to put into execution many policies advocated by the Labor Party before its advent to power.

The opposition, if united, is strong, but England in its characteristic manner is willing to afford the new government a fair chance. Hope is expressed that a foreign policy may be planned and put into execution and prove more satisfactory than that advocated by the preceding government. Industrial conditions are not entirely satisfactory, but are gradually improving.

Rentenmark Currency Should Help Germany

In Germany Mr. Mosehauer found a distinct note of encouragement now that a new currency system has been devised, and put into operation. In fact, officials of some of the largest German financial institutions feel that if the new Rentenmark currency can be maintained for at least six months, a great improvement in industrial conditions will follow. The Rentenmark money is based upon a real estate tax. Land owners are required to pay to the government 5 per cent in gold value of a 4 per cent valuation of their holdings. This fund is turned over to a bank entirely distinct from the Reichsbank. About 3,200,000,000 Rentenmarks, equal in value to $750,000,000, have been issued.

Edward Mosehauer

The consequence of this action has been highly beneficial. Farmers will now exchange their produce for the new German currency, something they were loath to do for the worthless paper mark. The intense desire to convert immediately Reichsbank paper currency into something of tangible value has ceased. Germany is on its way back to a gold basis. As a matter of fact, living costs in Germany are almost as high, figured in American money, as in the United States. German labor is working ten hours per day and German industrial leaders are striving to recover their former commercial position.

Manufacturers realize that the salvation of the country lies in hard work. The present copper consumption is estimated to be 6,000 tons electrolytic, and 2,000 tons of blister copper per month. Manufacturers thought their country could consume much more copper than it was purchasing at present, but a greater consumption depends upon a settlement of reparations and other political matters.

Other Continental Countries Active

"France has been and is exceedingly busy," said Mr. Mosehauer. "Consumption of copper has been splendid and business has been stimulated by the decline of the exchange value of the franc. The government of France contemplates a drastic tax program which will have its effect upon business but the prospect of a sustained demand for copper in France is good. Belgium and Sweden are both active. Sweden has a program for hydro-electric power developments that promises to help that country in the market for copper. Swedish consumers appreciated the work of the Copper Export Association as they felt that it was formed for the best interests of the market and that it relieved them of much bargaining for the metal.

Copper Export Association Protects Consumers

"I tried to clear some of the misconceptions regarding the C. E. A. in Europe whose policy has been constructive and for the best interests of consumers. I pointed out that it is an established practice of certain American producers to refrain from pressing copper on the market after large tonnages have been sold and the moment active and heavy buying has ceased. This is a protection to consumers as they require about three months to manufacture their products. The C. E. A. has attempted to protect consumers and for that reason has occasionally refrained from active competition in dull or declining markets. The C. E. A., although smaller in numbers, will continue its work.

"I found conditions abroad slowly improving with every indication that the demand for copper for 1924 would be equal to if not better than the demand in 1923."

Mining Dividends for February Substantially Unchanged

The following dividends were paid by mining and metallurgical companies in February, 1924:

Companies in the United States	Situation	Per Share	Total
American Smelting & Refining	Various	$1.25 Q	$152,495
Colorado Fuel & Iron pfd	Various	2.000 Q	40,000
General Development	Various	0.25 Q	30,000
Homestake Mining, g	S. D.	0.50 M	125,580
International Nickel pfd	W. Va., Ont.	1.50 Q	135,689
Miami Copper	Ariz.	0.50 Q	373,557
New Jersey Zinc	Various	2.00 Q	909,328
United Gold Mines	Colo.	0.01	48,000
U. S. Steel pfd	Various	1.75 Q	6,304,919
United Verde Extension, c	Ariz.	1.00 Q	1,050,000
Companies in other countries			
Amparo Mining, g,s	Jalisco	.03 Q	60,000
Aramayo en Bolivie, s, t, b, c	Bolivia	1.25 francs	750,000
Cerro de Pasco, c,s	Peru	$1.00 Q	$898,230
Hollinger Consolidated Gold	Ont.	0.05 4 wks.	246,000
Lake Shore, g	Ont.	0.02 Q	40,000
Total			$10,413,798

g, gold; c, copper; s, silver; t, tin; b, bismuth; Q, quarterly; M, monthly.

The distributions are, in general unchanged from those made for the previous quarter. The United Gold dividend is the first one paid by that company since January, 1920; it operates properties at Cripple Creek. The dividend normally paid by the Chief Consolidated at this time was passed, the money being required to build a mill.

Eagle-Picher Lead Decides on Wider Appeal to Investors

At a special meeting of the stockholders of the Eagle-Picher Lead Co. held in Cincinnati on Feb. 19, it was voted to exchange the present common stock for new common stock on a basis of five shares of the new for one of the old. Formerly there were 180,000 shares of common outstanding out of 200,000 authorized, par being $100. There is also outstanding 10,000 shares of 6 per cent preferred stock, of a par value of $100. The plan to split up the common stock is the result of a desire to obtain a wider and freer market for it. Until now, it has been closely held and has not been quoted on any exchange. Though no arrangements have yet been made for listing the new stock, it is probable that this will be done.

Company Reports

Utah Copper Co.

A statement of the operations of the Utah Copper Co. for the fourth quarter of the fiscal and calendar year 1923 follows:

The total net production of copper from all sources was 55,308,760 lb., a decrease of 3,775,840 lb., as compared with the output of the previous quarter, as shown in the following statement of production, by months, for the respective periods:

Fourth Quarter, 1923	Lbs.	Third Quarter, 1923	Lbs.
October	19,024,780	July	19,529,362
November	18,750,687	August	20,521,352
December	17,533,293	September	19,033,832
Total	55,308,760		59,084,546
Average monthly production	18,436,253		19,694,849

During the quarter the Arthur plant treated 1,720,100 dry tons of ore and the Magna plant 1,706,300 dry tons, a total for both plants of 3,426,400 dry tons. During the year a total of 11,167,800 tons of ore was treated at both plants.

The average grade of ore treated at the mills was 1.08 per cent copper and the average mill recovery of copper in the form of concentrates was 77 per cent of that contained in the ore, as compared with 1.12 per cent copper and 82 per cent recovery, respectively, for the previous quarter. The lower mill recovery for the current quarter was due in part to the fact that a large portion of the tonnage treated was extracted from some of the old stoped areas where the ore had become partially oxidized.

The average cost per net pound of copper produced, including depreciation of plant and equipment and all fixed and general expenses and after crediting gold, silver and miscellaneous earnings, was 9.08c., as compared with 8.51c. for the preceding quarter computed on the same basis. The value of gold and silver recovered and the miscellaneous earnings amounted to 1.05c. per lb. of copper, as compared with 1.08c. for the previous quarter.

The following tabulation shows the financial results of the company's operations for the quarter as compared with the previous quarter:

	Fourth Quarter 1923	Third Quarter 1923
Net profit from copper production	$1,827,869.32	$3,398,478.88
Miscellaneous income, including gold and silver	579,196.57	636,616.64
Bingham & Garfield Railway Company dividend	100,000.00	.....
Total income	$2,507,065.89	$4,035,095.52
Depreciation	339,998.73	273,718.32
To surplus	$2,167,067.16	$3,761,377.20

Earnings for the fourth quarter are computed on the basis of 12.807c. per lb. carrying price for copper, as compared with 14.88c. for the third quarter, 14.723c. for the second quarter and 15.595c. for the first quarter.

A quarterly distribution to stockholders of $1 per share was made on Dec. 31, 1923, and amounted to $1,624,490.

The total capping removed during the quarter was 708,600 cu.yd., as compared with 664,218 cu.yd. for the previous quarter.

The ore delivery department transported a total of 3,616,561 tons of ore, being an average of 39,310 tons per diem, as compared with 3,510,079 tons and 38,153 tons, respectively, for the previous quarter.

The Bingham & Garfield Railway Co. transported a total of 330,382 tons of freight, or an average of 3,591 tons per diem.

Satisfactory progress was made during the year in advancing the extensive reconstruction program at the Magna concentrator. All of the improvements and betterments authorized, including the construction of a new primary crushing plant and railroad car tipple, remodelling of concentration equipment and the installation of a complete flotation plant, are practically completed, bringing the mill up to an efficient capacity of about 24,000 tons of ore per day. With this enlarged capacity and material improvement in recoveries, the combined capacity of both Arthur and Magna plants is now approximately 40,000 tons of ore per day. However, full advantage of these improved facilities will not be entirely realized during the remaining winter months and early spring on account of the usual seasonal storms and other delays incident to operating under severe weather conditions.

New Jersey Zinc Co.

A statement for the quarter ended Dec. 31, 1923, of the New Jersey Zinc Co. follows:

Income (including dividends from subsidiary companies) after deductions for expenses, taxes, maintenance, repairs, depreciation, depletion and contingencies		$1,411,144.59
Deduct		
Interest on first mortgage bonds		40,000.00
Net income		$1,371,144.59
Deduct		
Dividend 2 per cent payable February 9, 1924	$979,632.00	
Employees' profit-sharing distribution	360,000.00	1,339,632.00
Surplus for the quarter		$31,512.59
Summary		
Net income for the first quarter		$1,865,455.79
Net income for the second quarter		2,077,010.23
Net income for the third quarter		1,050,793.25
Net income for the fourth quarter		1,371,144.59
Net income for the year		$6,364,403.86
Deduct		
Dividends declared		$4,883,234.00
Employees' profit-sharing distribution	360,000.00	5,243,234.00
Surplus for the year		$1,121,169.86

Lucky Tiger-Combination Gold Mining Co.

The Lucky Tiger-Combination Gold Mining Co. paid in 1922 $1.03 per share, or $736,797.11, and the company's dividends for 1923 amounted to $1.07, a total of $763,410.59.

MINING STOCKS

Week Ended February 16, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb	...	...	*40	...	...
Anaconda	New York	41	38	40½	De.15, Ja.21, Q	0.75
Aracadian Consol.	Boston	2	1⅞	1⅞	...	...
Ariz. Com'l.	Boston	9¼	8½	9¼	Ja.15, Ja.31	0.50
Calaveras	N. Y. Curb	...	...	1⅛	...	...
Calumet & Arizona	Boston	47	44½	45½	De.7, De.24, Q	0.50
Cal. & Hecla (New)	Boston	18½	16⅞	18	De. 1, De. 17	0.50
Canario Copper	N. Y. Curb	2⅛	2 1/16	2⅛	...	...
Cerro de Pasco	New York	48½	46	47¼	Ja. 17, Feb. 1	1.00
Chile Copper	New York	28⅜	27½	28	Mh.1 Mh.20, Q	0.62½
Chino	New York	20½	17⅞	20⅛	Sept. '20, Q	0.37
Con. Coppermines	N. Y. Curb	2⅜	2 1/16	2¼	...	...
Copper Range	Boston	26½	23	26	May '23, Q	1.00
Crystal Copper	Boston Curb	*79	*76	*77	...	...
Davis-Daly	Boston	4⅛	3 13/16	3 13/16	Mar. '20, Q	0.25
East Butte	Boston	5⅛	4¼	5	Dec. '19, A	0.50
First National	Boston Curb	*38	*21	*26	Feb. '19, SA	0.15
Franklin	Boston	*95	*75	*80	...	...
Gadsden Copper	Boston Curb	*40	*30	*35	...	...
Granby Consol.	New York	17¼	14¾	17⅛	May '19, Q	1.25
Greene-Cananea	New York	16½	15	16	Nov. '20, Q	0.50
Hancock	Boston	...	...	2	...	...
Howe Sound	N. Y. Curb	3	2⅞	2⅞	Ja.2, Ja.15	0.05
Inspiration Consol.	New York	27⅛	26¼	27	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	...	...	3	May 23, K	0.15
Isle Royale	Boston	18	17	17⅝	Se. 1, Se. 15,	0.50
Jerome Verde Dev.	N. Y. Curb	1⅛	1⅛	1⅛	...	...
Kennecott	New York	38⅜	36⅜	38	De.7, Ja. 2, Q	0.75
Keweenaw	Boston	*50	*50	*50	...	...
Lake Copper	Boston	1⅛	1⅛	1⅛	...	...
Magma Copper	New York	33⅜	32	33⅜	Jan. '19, Q	0.50
Mason Valley	N. Y. Curb	...	...	1⅜	...	...
Mass Consolidated	Boston	*65	*50	*50	Nov. '17, Q	1.00
Miami Copper	New York	23⅜	22⅜	23	Fe. 1, Fe. 13, Q	0.50
Michigan	Boston	...	...	*50	...	...
Mohawk	Boston	35½	31	34	Se. 22, Oc. 13,	1.00
Mother Lode Coa.	New York	9⅛	8½	9	De.14, De.31	0.50
Nevada Consol.	New York	14	12⅜	14	Sept. '20, Q	0.25
New Cornelia	Boston	17⅞	17	17⅛	Au.3, Au.20, Q	0.25
New Dominion	N. Y. Curb	2⅜	2⅛	2⅛	...	...
North Butte	Boston	3 3/16	3	3⅛	Oct. '18, Q	0.25
Ohio Copper	N. Y. Curb	*79	*73	*73	...	...
Old Dominion	Boston	17¾	15½	17	Dec. '18, Q	1.00
Osceola	Boston	...	...	31½	June '23, Q	1.00
Phelps Dodge	Open Mar.	†140	†130	....	De.20, Ja.2 Q	1.00
Quincy	Boston	23½	20½	23	Mar. '20, Q	1.00
Ray Consolidated	New York	12	10⅝	12	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	*23	*17	*17	...	...
St. Mary's Min. Ld.	Boston	34	31½	33	No.9, De.11, K	1.00
Seneca Copper	New York	5⅜	5⅛	5⅛	...	...
Shannon	Boston	*70	*50	*50	Nov. '17, Q	0.25
Shattuck Arizona	New York	6⅛	6	6⅛	Jan. '20, Q	0.25
South Lake	Boston	...	...	⅛	...	...
Superior & Boston	Boston	*95	*75	*95	...	...
Tenn. C. & C. cfs.	New York	9⅛	8⅞	9	De.31, Ja.15, Q	0.25
Tuolumne	Boston	*45	*38	*42	May '13,	0.10
United Verde Ex.	N. Y. Curb	26½	25⅛	26⅛	Ja.1, Fe. 1, Q	1.00
Utah Consol.	Boston	...	...	*1	Sept. '18,	0.25
Utah Copper	New York	68	65	68	De.3, De.15, Q	1.00
Utah Metal & T.	Boston	*40	*35	*40	Dec. '17,	0.30
Victoria	Boston	...	...	*75	...	...
Walker Mining	N. Y. Curb	3⅛	3	3	...	...
Winona	Boston	*20	*15	*20	...	...
Wolverine	Boston	....	....	5¾	...	...
NICKEL-COPPER						
Internat. Nickel	New York	14⅛	13	13⅛	Mar. '19,	0.50
Internat. Nickel pfd.	New York	80⅛	80⅛	80⅛	Ja.17, Fe.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	2⅞	2⅝	2⅝	...	...
National Lead	New York	148	138	142½	Fe.21, Mh.15, Q	1.75
National Lead pfd.	New York	114	113	114	No. 23, De. 15	1.75
St. Joseph Lead	New York	26⅞	23½	25⅞	De.9, De.20	0.50
ZINC						
Am. Z. L. & S.	New York	10⅜	8½	9⅜	May '20	1.00
Am. Z. L. & S. pfd.	New York	34⅞	30	34	Nov. '20, Q	1.50
Butte C. & Z.	New York	6⅛	5⅛	6⅛	Ma.. '23,	0.50
Butte & Superior	New York	20⅜	17⅞	19⅛	Je.15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	5⅜	5	5⅛	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	151	150	151	Ja.31, Fe.9	2.00
United Zinc	N. Y. Curb	....	....	*25	...	...
Yellow Pine	Los Angeles	*80	*80	*80	Dec. '23	0.03
SILVER						
Alvarado	N. Y. Curb	....	....	1⅛	...	...
Batopilas Mining	New York	...	...	⅛	Dec. '07, I	0.12
Beaver Consol.	Toronto	*28½	*28½	*28	May '20, K	0.03
Castle-Trethewey	Toronto	†*62	†*61	*60	...	...
Coniagas	Toronto	2.30	2.30	2.30	Oc.19, No.1, '23	0.02½
Crown Reserve	Toronto	†*64	†*61½	*61	Jan. 17,	0.05
Kerr Lake	N. Y. Curb	2	2	2	Oc. 1, Oc. 15, Q	0.12½
La Rose	Toronto	†*24	†*21	*24½	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*15	*14	*14½	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	3.75	3.50	3.60	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	6⅛	6⅛	6⅛	Ja.1, Ja.21, QX	0.30
Ontario Silver	New York	...	...	7½	Jan. '19, Q	0.50
Temiskaming	Toronto	*32	*31½	*32	Jan. '20, K	0.40

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	¼	⅛	¼	...	...
Alaska Juneau	New York	1⅛	1	1	...	...
Carson Hill	Boston	2½	2⅛	2⅛	...	...
Cresson Consol. G	N. Y. Curb	4⅛	3⅞	3⅞	De.31, Ja.10, Q	0.10
Dome Mines	New York	18⅛	17⅞	17⅞	De.31, Ja.2, Q	0.50
Golden Cycle	Colo. Springs	1.25	1.25	1.25	De. '22, Q	0.02
Hollinger Consol.	Toronto	†12.10	†12.00	11.90	Fe.7, Fe.25, M	0.05
Homestake Mining	New York	55	54⅜	54⅜	Fe.20, Fe.25, M	0.50
Kirkland Lake	Toronto	†*23¾	†*21⅛	*20⅛	...	...
Lake Shore	Toronto	†3.60	†3.58	3.57	Fe.2, Fe.24, Q	0.02
McIntyre-Porcupine	New York	17⅛	16½	16⅞	De. 1, Ja. 2,	0.25
Portland	Colo. Springs	...	...	*40	Oct. '20, Q	0.01
Teck-Hughes	N. Y. Curb	1 5/16	1⅛	1 5/16	...	...
Tom Reed	Los Angeles	*47	*45	*45	Dec. '19,	0.02
United Eastern	N. Y. Curb	1	*91	*99	Ja.8, Ja.28, Q	0.15
Vipond Cons.	Toronto	†1.33	†1.21	1.20	...	...
Wright-Hargreaves	Toronto	3.00	2.88	3.00	Se.15, Oc.1, Q	0.02
Yukon Gold	N. Y. Curb	*66	*60	*60	June '18,	0.02½
GOLD AND SILVER						
Boston-Mont. Corp.	N. Y. Curb	...	...	*17	...	...
Con. Cortez	N. Y. Curb	*67	*63	*67	...	...
Con. Virginia	San Francisco	7⅛	6⅛	6⅞	...	...
Continental Mines	N. Y. Curb	....	....	4	...	...
Dolores Esperanza	N. Y. Curb	*70	*65	*65	Jy. 1, Jy. 10 Q	0.05
Jib Consol	N. Y. Curb	....	....	*25	...	...
Premier Gold	N. Y. Curb	...	...	2⅛	...	...
Tonopah Belmont	N. Y. Curb	*70	*62	*62	Apr. '23, Q	0.05
Tonopah Divide	N. Y. Curb	...	...	*39	Se.22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	2 1/16	1 1/16	2	Dec. 11, Ja. 1	0.05
Tonopah Mining	N. Y. Curb	....	....	1 11/16	Se.30, Oc. 1	0.07½
Unity Gold	N. Y. Curb	1 3/16	1⅛	1 1/16	...	...
West End Consol.	N. Y. Curb	*75	*65	*75	Mar. '23, Q	0.05
SILVER-LEAD						
Ahumada	Boston Curb	6⅛	6⅛	6⅛	De.15, Ja.2, X	0.10
Bingham Mines	Boston	17	17	17	Sept. 19, Q	0.25
Cardiff M. & M.	Salt Lake	*85	*85	*85	Dec. '20,	0.15
Chief Consol.	Boston Curb	4⅛	4	4	Ja.11, Fe.1, Q	0.10
Columbus Rexall	Salt Lake	*30	*27½	*27½	Aug. '22	0.03
Consol. M. & S.	Montreal	37	36½	36½	Oct. '20, Q	0.62½
Daly Mining	Salt Lake	177½	175	177½	July '20	0.10
Erupcion	Boston Curb	2⅛	2⅛	2⅛	De. 15, Ja. 2, X	0.125
Federal M. & S.	New York	11½	10⅛	11	Jan., '09	1.50
Federal M. & S. pfd.	New York	46¼	42½	46	Fe.26, Mh.15, Q.	1.75
Florence Silver	Spokane	*24	*23½	*24	Apr. '19, QX	0.01
Hecla Mining	N. Y. Curb	9⅛	8⅛	9⅛	Fe.15, Mh.15 Q	150.25
Indian Mines	N. Y. Curb	....	....	*64	...	...
Iron Blossom Con.	N. Y. Curb	*31	*31	*31	Oct. 26, '23,	0.02
Marsh Mines	N. Y. Curb	*12	*12	*12	June '21, I	0.02½
Park City	Salt Lake	....	....	4.75	Jan. 24,	0.15
Park Utah	N. Y. Curb	....	....	4⅜	De.8, Ja.2, Q	0.15
Prince Consol.	Salt Lake	...	...	*75	Nov. '17,	0.02
Silversmith	Spokane	*33	*32	*32½	Oc. 1, Oc. 10	0.01
Simon Silver-Lead	N. Y. Curb	*1	*1	*1	...	...
Tamarack-Custer	Spokane	1.36	3.35	1.35	Se.30, Oc. 1, K	0.02
Tintic Standard	Salt Lake	4.00	3.95	3.97½	Ja. 5, X	0.25
Utah-Apex	Boston	3⅛	2⅛	3	June '23, QX	0.50
IRON						
Bethlehem Steel	New York	61¼	55⅛	57⅞	Mh. 1, Ap. 1, Q	1.25
Char. Iron	Detroit	....	....	1⅛	...	...
Char. Iron pfd.	Detroit	...	...	2	...	...
Colorado Fuel & Iron	New York	28	24⅛	25½	Fe.11, Fe.25 Q	2.00
Col. Fuel & Iron pfd.	New York	....	....	102	Fe.11, Fe.25, Q	2.00
Gt. North'n Iron Ore	New York	30½	29	29⅛	De.10, De.27	2.00
Inland Steel	N. Y. Curb	...	...	46	Mh.15, Apl. 1 Q	0.62½
Mesabi Iron	N. Y. Curb	7	6½	6⅝	...	...
Replogle Steel	New York	12⅝	11⅛	11⅛	...	...
Republic I. & S.	New York	61⅞	54⅛	56⅛	May '21	1.50
Republic I. & S. pfd.	New York	94	93	93	Mh.20, Ap.1QX	2.75
Sloss-Sheffield S. & I.	New York	67⅛	59	61⅛	Feb. '21,	1.50
Sloss-Shef. S. & I. pfd.	New York	87½	87	87½	De.20, Ja.2, Q	1.75
U. S. Steel	New York	108⅛	103½	104⅛	Mh. 29, QX	1.75
U. S. Steel pfd.	New York	119⅜	119¼	119⅜	Mh.29, Q	1.75
Virginia I. C. & C.	New York	....	....	49	De.15, Ja. 2	1.50
Virginia I.C. & C. pfd.	New York	....	....	80	De.15, Ja.22	2.50
VANADIUM						
Vanadium Corp.	New York	33½	29⅜	31⅛	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	...	...	30	Se.29, Oc.15 Q	1.00
Asbestos Corp. pfd.	Montreal	59½	59¼	59½	Se.29, Oc.15, Q	1.50
SULPHUR						
Freeport Texas	New York	10⅛	9⅞	10	Nov '19, Q	1.00
Texas Gulf	New York	64⅜	62½	63	De.1, De.15QX	2.00
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	4	3⅜	3⅜	...	...
MINING, SMELTING AND REFINING						
Amer. Metal	New York	45⅛	43⅜	44½	Fe.18, Mh.1, Q	0.75
Amer. Metal pfd.	New York	113½	112½	113⅜	Fe.20, Mh.1, Q	1.75
Amer. Sm. & Ref.	New York	63½	60	62⅜	Ja. 11, Fe. 1, Q	1.25
Amer. Sm. & Ref. pfd.	New York	99½	98½	99¼	Fe.20, Mh.1,	1.75
U. S. Sm. R. & M.	New York	23⅞	21	23	Jan. '21, Q	0.50
U.S. Sm. R. & M. pfd.	New York	40½	40½	40½	Ja.7, Ja.15 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M. Monthly. K, Irregular. I, Initial, X, Includes extra.

Toronto quotations courtesy Arthur E. Moysey; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, Colorado Springs Stock Exchange.